



PROJECT MANUAL

ODENHEIMER BUILDING
DIVISIONS 00 - 14

18 December 2025

ODENHEIMER BUILDING
6500 MAGAZINE STREET
NEW ORLEANS, LOUISIANA

EDR Project No. 22071

VOLUME 1 OF 2

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SECTION 00 01 03
PROJECT DIRECTORY

PART 1 GENERAL

1.01 PROJECT DIRECTORY

A. Owner: Audubon Commission in Conjunction with Audubon Nature Institute (ANI).

1. Address: 6500 Magazine Street.
2. City, State, Zip: New Orleans, Louisiana 70118.
3. Phone: (504) 581-4629.
4. Contacts:
 - a. Jackson Kerby, VP Construction and Exhibitory
 - b. E-mail: jkerby@auduboninstitute.org
 - c. Jonathan Sanders, Project Manager
 - d. E-mail: jsanders@auduboninstitute.org

B. Architect: Eskew+Dumez+Ripple.

1. Address: 400 Lafayette Street, Suite 300
2. City, State, Zip: New Orleans, LA 70130.
3. Phone: (504) 561-8686.
4. Contacts:
 - a. Christian Rodriguez, Principal-in-Charge
 - b. E-mail: crodriguez@eskewdumezripple.com
 - c. Haley Robinson, Project Manager
 - d. E-mail: hrobinson@eskewdumezripple.com
 - e. Caroline Garfield, Designer
 - f. E-mail: cgarfield@eskewdumezripple.com

C. Landscape and Animal Habitat: CLR Designs, Inc. (CLR)

1. Address: 833 Chestnut Street, Suite 909
2. City, State, Zip: Philadelphia, PA 19107

3. Phone: (215) 564-0250
 4. Contact: Gregory J. Dykstra, Principal
 5. E-mail: gdykstra@clrdesign.com
- D. Structural/Civil Engineer: Batture, LLC.
1. Address: 5110 Freret Street.
 2. City, State, Zip: New Orleans, LA 70115.
 3. Phone: (504) 533-8644.
 4. Contact: Mary Schambeau Johnson
 5. E-mail: msjohnson@batture-eng.com
- E. Mechanical/Electrical Engineer: Salas O'Brien
1. Address: 5215 Essen Lane, Suite 100,
 2. State, Zip: Baton Rouge, LA 70809
 3. Phone: (225) 766-8002
 4. Contacts:
 - a. Landon Kinler
 - b. E-mail: landon.kinler@salasobrien.com

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SEALS PAGE

This Seals/Stamp Page responds to the requirements of Louisiana Title 46, Professional
Occupational
Standards, Part 1, Architects Chapter 11. Administration, Rule 1105 B.

The following specification sections of the Project Manual have been assembled by
ESKEW+DUMEZ+RIPPLE and were prepared by me or under my responsible supervision.

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07 8413	Penetration Firestopping
07 8443	Joint Firestopping
07 9200	Joint Sealants
07 9500	Expansion Control
08 0350	Restoration of Wood Windows
08 1113	Hollow Metal Doors and Frames
08 1613	Fiberglass Doors and Frames
08 3113	Access Doors and Frames
08 4413	Glazed Aluminum Curtain Walls
08 5113	Aluminum Windows
08 6200	Unit Skylights
08 7100	Door Hardware
08 8000	Glazing
08 8300	Mirrors
08 9119	Fixed Louvers
09 0130	Plaster Patching
09 0561	Moisture Vapor Emission Control
09 2216	Non-Structural Metal Framing
09 2400	Cement Plastering
09 2900	Gypsum Board
09 3000	Tiling
09 6240	Structural Glass Flooring
09 6513	Resilient Base and Accessories
09 7200	Wall Covering
09 9113	Exterior Painting
09 9123	Interior Painting
10 1423	Panel Signage
10 2113	Toilet Compartments
10 2600	Wall Protection
10 2800	Toilet and Bath Accessories
10 4413	Fire Protection Cabinets
10 4416	Fire Extinguishers
12 4813	Entrance Floor Mats and Frames



The following specification sections of the Project Manual have been assembled by CLR
DESIGN, INC. and were prepared by me or under my responsible supervision.

01 5639	Temporary Tree and Plant Protection
01 7117	Animal Management Requirements of Construction
03 3712	Exhibit Rockwork
03 3712.01	Exhibit Rockwork Theming & Image Book
03 3713	Shotcrete
05 5965	Animal Caging Rigid Panel Systems
06 7413	Fiberglass Reinforced Gratings
07 1613	Polymer Modified Cement Waterproofing
07 9201	Joint Sealants – Animal Exhibits
08 8859	Specialty Glass and Glazing
09 9300	Staining and Transparent Finishing
09 9713	High Performance Epoxy Coatings
10 6600	Woven Mesh Structures and Rigging Systems
32 1816.13	Playground Protective Surfacing
32 3113	Chain Link Fences and Gates
32 3129	Fences and Gates
32 8400	Planting Irrigation
32 9115	Planting Soils and Animal Substrates
32 9200	Turf and Grasses
32 9300	Plants



The following specification sections of the Project Manual have been assembled by
BATTURE, LLC and were prepared by me or under my responsible supervision.

03 0100	Concrete Repair
03 3000	Cast-In-Place Concrete
04 2200	Concrete Unit Masonry
05 1200	Structural Steel
05 3100	Steel Deck
06 1100	Wood Framing
06 1500	Wood Decking
31 2323	Fill and Backfill
31 2333	Trenching and Site Utilities
31 2500	Erosion and Sediment Controls
31 2510	Environmental Protection and Stormwater Pollution Prevention
31 3700	Riprap
32 1313	Concrete Paving
32 1315	Granular Material
33 4000	Drains and Culverts
33 4100	Manhole Catchbasins, Drop inlets and Clean-outs
33 4236	Stormwater Trench Drains
33 4600	Subdrainage

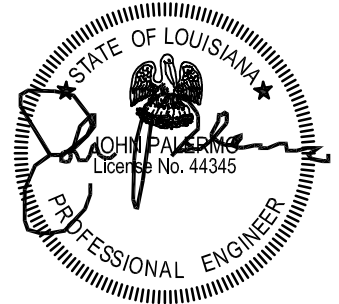


The following specification sections of the Project Manual have been assembled by Salas O'Brien
and were prepared by me or under my responsible supervision.

22 0100	Plumbing Operating and Maintenance Manuals
22 0500	Plumbing General Provisions
22 0510	Plumbing Contract Quality Control
22 0512	Plumbing Shop Drawings, Coordination Drawings, And Product Data
22 0513	Electrical Provisions of Plumbing Work
22 0514	Plumbing Alterations Project Procedures
22 0517	Plumbing Access Doors
22 0533	Pipe Heat Tracing
22 0719	Plumbing Piping Insulation
22 1116	Domestic Water Piping and Appurtenances
22 1123	Domestic Water Pumps
22 1124	Domestic Water Pump Booster Package
22 1316	Soil, Waste, And Sanitary Drain Piping, Vent Piping and Appurtenances
22 1333	Sanitary Sewer Lift Station
22 1413	Roof Drainage Piping and Appurtenances
22 2000	Plumbing Pipe and Fittings - General
22 3100	Domestic Water Softening System
22 3101	Scale Formation Protection System
22 3313	Instantaneous Electric Water Heater
22 3334	Electric Water Heater
22 3430	Gas-Fired Domestic Water Heater/Tank Type State Sandblaster
22 4000	Plumbing Fixtures and Fixture Carriers
22 6311	Gas Piping and Appurtenances
23 0100	HVAC Operating and Maintenance Manuals
23 0500	Mechanical General Provisions
23 0510	Mechanical Contract Quality Control
22 0511	Mechanical Alterations Project Procedures
23 0512	HVAC Shop Drawings, Coordination Drawings, And Product Data
23 0513	Electrical Provisions of HVAC Work
23 0514	HVAC Condensate Drain Piping
23 0515	HVAC System Earthwork
23 0516	Excavating, Backfilling, and Compacting for Utilities Outside Building Slab
23 0517	Mechanical Access Doors
23 0548	Vibration Isolation
23 0593	Testing, Balancing, And Adjusting (Tab) Of Environmental Systems
23 0594	Coordination of Testing and Balancing
23 0713	External Duct Insulation
23 0719	HVAC Piping Insulation
23 2000	Mechanical Pipe and Fittings - General
23 2300	Refrigerant Piping and Appurtenances
23 3113	Ductwork
23 3416	Fans
23 3713	Air Devices
23 4100	Air Filtration
23 6300	Air Cooled Condensing Unit
23 7313	Air Handling Units
23 8123	Packaged Outdoor Heat Pump Air Conditioner with Energy Recovery
23 8216	Heating and Cooling Coils
23 8239	Electric Unit Heaters



26 0105	Electrical Operation and Maintenance Manuals
26 0500	Electrical General Provisions
26 0505	Electrical Alterations Project Procedures
26 0509	Electrical Utility Coordination and Service Entrance
26 0510	Contract Quality Control
26 0512	Electrical Shop Drawings, Coordination Drawings, And Product Data
26 0519	Conductors and Connectors
26 0526	Electrical Grounding
26 0533	Conduit Systems
26 0535	Electrical Connections for Equipment
26 0537	Electrical Boxes and Fittings
26 0538	Electrical Floor Boxes and Fittings
26 1215	Dry Type Transformers
26 2416	Panelboards and Enclosures
26 2425	Enclosed Switches and Circuit Breakers
26 2773	Line Voltage and Wiring Devices
26 3214	Diesel Standby Generator Set with Transfer Switch
26 5113	Lighting Fixtures and Lamps
26 5600	Site Lighting
28 3100	Fire Detection and Alarm System



SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to proposers but will not be part of Contract Documents, as follows:
- B. Original Odenheimer Drawings; *The Odenheimer Aquarium for Audubon Park*; dated 1-6-1923
- C. Odenheimer Architectural Renovations; *Audubon Park & Zoological Garden Odenheimer Complex Architectural Renovations*; dated 12-19-1986
- D. Komodo Dragon Exhibit; Komodo Dragon Exhibit Audubon Park Zoo; dated 10-15-1996

SECTION 00 60 00
PROJECT FORMS

PART 1 GENERAL

1.01 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
 - 1. AIA Document A133, "Standard Form of Agreement between Owner and Contractor, Construction Manager as Constructor, Guaranteed Maximum Price."
 - a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 - 2. The General Conditions are included in the Project Manual in Section 00 72 00
 - 3. The Supplementary Conditions for Project are separately prepared and included in the Project Manual in Section 00 73 00

1.02 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; docspurchases@aia.org; (800) 942-7732.
- C. Preconstruction Forms:
 - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond" or other document acceptable to Owner.
- D. Information and Modification Forms:
 - 1. Form of Request for Proposal: AIA Document G709, "Proposal Request."
 - 2. Change Order Form: AIA Document G701, "Change Order."
 - 3. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710, "Architect's Supplemental Instructions" or equivalent.
 - 4. Form of Change Directive: AIA Document G714, "Construction Change Directive."
- E. Payment Forms:
 - 1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."
 - 2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."

3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."

END OF SECTION 00 60 00

DRAFT AIA® Document A133™ – 2019

Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month, and year.)

BETWEEN the Owner:
(Name, legal status, address, and other information)

« »
« »
« »
« »

and the Construction Manager:
(Name, legal status, address, and other information)

« »
« »
« »
« »

for the following Project:
(Name, location, and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address, and other information)

« »
« »
« »
« »

The Owner and Construction Manager agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

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6	COMPENSATION FOR CONSTRUCTION PHASE SERVICES
7	COST OF THE WORK FOR CONSTRUCTION PHASE
8	DISCOUNTS, REBATES, AND REFUNDS
9	SUBCONTRACTS AND OTHER AGREEMENTS
10	ACCOUNTING RECORDS
11	PAYMENTS FOR CONSTRUCTION PHASE SERVICES
12	DISPUTE RESOLUTION
13	TERMINATION OR SUSPENSION
14	MISCELLANEOUS PROVISIONS
15	SCOPE OF THE AGREEMENT

EXHIBIT A GUARANTEED MAXIMUM PRICE AMENDMENT

EXHIBIT B INSURANCE AND BONDS

ARTICLE 1 INITIAL INFORMATION

§ 1.1 This Agreement is based on the Initial Information set forth in this Section 1.1.

(For each item in this section, insert the information or a statement such as "not applicable" or "unknown at time of execution.")

§ 1.1.1 The Owner's program for the Project, as described in Section 4.1.1:

(Insert the Owner's program, identify documentation that establishes the Owner's program, or state the manner in which the program will be developed.)

« »

§ 1.1.2 The Project's physical characteristics:

(Identify or describe pertinent information about the Project's physical characteristics, such as size; location; dimensions; geotechnical reports; site boundaries; topographic surveys; traffic and utility studies; availability of public and private utilities and services; legal description of the site, etc.)

« »

§ 1.1.3 The Owner's budget for the Guaranteed Maximum Price, as defined in Article 6:

(Provide total and, if known, a line item breakdown.)

« »

§ 1.1.4 The Owner's anticipated design and construction milestone dates:

- .1 Design phase milestone dates, if any:

« »

- .2 Construction commencement date:

« »

- .3 Substantial Completion date or dates:

« »

- .4 Other milestone dates:

« »

§ 1.1.5 The Owner's requirements for accelerated or fast-track scheduling, or phased construction, are set forth below:
(Identify any requirements for fast-track scheduling or phased construction.)

« »

§ 1.1.6 The Owner's anticipated Sustainable Objective for the Project:
(Identify and describe the Owner's Sustainable Objective for the Project, if any.)

« »

§ 1.1.6.1 If the Owner identifies a Sustainable Objective, the Owner and Construction Manager shall complete and incorporate AIA Document E234™–2019, Sustainable Projects Exhibit, Construction Manager as Constructor Edition, into this Agreement to define the terms, conditions and services related to the Owner's Sustainable Objective. If E234–2019 is incorporated into this agreement, the Owner and Construction Manager shall incorporate the completed E234–2019 into the agreements with the consultants and contractors performing services or Work in any way associated with the Sustainable Objective.

§ 1.1.7 Other Project information:
(Identify special characteristics or needs of the Project not provided elsewhere.)

« »

§ 1.1.8 The Owner identifies the following representative in accordance with Section 4.2:
(List name, address, and other contact information.)

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« »

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« »

§ 1.1.9 The persons or entities, in addition to the Owner's representative, who are required to review the Construction Manager's submittals to the Owner are as follows:
(List name, address and other contact information.)

« »

§ 1.1.10 The Owner shall retain the following consultants and contractors:
(List name, legal status, address, and other contact information.)

.1 Geotechnical Engineer:

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.2 Civil Engineer:

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.3 Other, if any:

(List any other consultants retained by the Owner, such as a Project or Program Manager.)

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§ 1.1.11 The Architect's representative:
(List name, address, and other contact information.)

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§ 1.1.12 The Construction Manager identifies the following representative in accordance with Article 3:
(List name, address, and other contact information.)

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§ 1.1.13 The Owner's requirements for the Construction Manager's staffing plan for Preconstruction Services, as required under Section 3.1.9:
(List any Owner-specific requirements to be included in the staffing plan.)

<< >>

§ 1.1.14 The Owner's requirements for subcontractor procurement for the performance of the Work:
(List any Owner-specific requirements for subcontractor procurement.)

<< >>

§ 1.1.15 Other Initial Information on which this Agreement is based:

§ 1.2 The Owner and Construction Manager may rely on the Initial Information. Both parties, however, recognize that such information may materially change and, in that event, the Owner and the Construction Manager shall appropriately adjust the Project schedule, the Construction Manager's services, and the Construction Manager's compensation. The Owner shall adjust the Owner's budget for the Guaranteed Maximum Price and the Owner's anticipated design and construction milestones, as necessary, to accommodate material changes in the Initial Information.

§ 1.3 Neither the Owner's nor the Construction Manager's representative shall be changed without ten days' prior notice to the other party.

ARTICLE 2 GENERAL PROVISIONS

§ 2.1 The Contract Documents

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract and are as fully a part of the Contract as if attached to this Agreement or repeated herein. Upon the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal, the Contract Documents will also include the documents described in Section 3.2.3 and identified in the Guaranteed Maximum Price Amendment and revisions prepared by the Architect and furnished by the Owner as described in Section 3.2.8. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. If anything in the other Contract Documents, other than a Modification, is inconsistent with this Agreement, this Agreement shall govern. An enumeration of the Contract Documents, other than a Modification, appears in Article 15.

§ 2.2 Relationship of the Parties

The Construction Manager accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Construction Manager's skill and judgment in furthering the interests of the Owner to furnish efficient construction administration, management services, and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish or approve, in a timely manner, information required by the Construction Manager and to make payments to the Construction Manager in accordance with the requirements of the Contract Documents.

§ 2.3 General Conditions

§ 2.3.1 For the Preconstruction Phase, AIA Document A201™-2017, General Conditions of the Contract for Construction, shall apply as follows: Section 1.5, Ownership and Use of Documents; Section 1.7, Digital Data Use and Transmission; Section 1.8, Building Information Model Use and Reliance; Section 2.2.4, Confidential Information; Section 3.12.10, Professional Services; Section 10.3, Hazardous Materials; Section 13.1, Governing Law. The term "Contractor" as used in A201-2017 shall mean the Construction Manager.

§ 2.3.2 For the Construction Phase, the general conditions of the contract shall be as set forth in A201-2017, which document is incorporated herein by reference. The term "Contractor" as used in A201-2017 shall mean the Construction Manager.

ARTICLE 3 CONSTRUCTION MANAGER'S RESPONSIBILITIES

The Construction Manager's Preconstruction Phase responsibilities are set forth in Sections 3.1 and 3.2, and in the applicable provisions of A201-2017 referenced in Section 2.3.1. The Construction Manager's Construction Phase responsibilities are set forth in Section 3.3. The Owner and Construction Manager may agree, in consultation with the Architect, for the Construction Phase to commence prior to completion of the Preconstruction Phase, in which case, both phases will proceed concurrently. The Construction Manager shall identify a representative authorized to act on behalf of the Construction Manager with respect to the Project.

§ 3.1 Preconstruction Phase

§ 3.1.1 Extent of Responsibility

The Construction Manager shall exercise reasonable care in performing its Preconstruction Services. The Owner and Architect shall be entitled to rely on, and shall not be responsible for, the accuracy, completeness, and timeliness of services and information furnished by the Construction Manager. The Construction Manager, however, does not warrant

or guarantee estimates and schedules except as may be included as part of the Guaranteed Maximum Price. The Construction Manager is not required to ascertain that the Drawings and Specifications are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Construction Manager shall promptly report to the Architect and Owner any nonconformity discovered by or made known to the Construction Manager as a request for information in such form as the Architect may require.

§ 3.1.2 The Construction Manager shall provide a preliminary evaluation of the Owner's program, schedule and construction budget requirements, each in terms of the other.

§ 3.1.3 Consultation

§ 3.1.3.1 The Construction Manager shall schedule and conduct meetings with the Architect and Owner to discuss such matters as procedures, progress, coordination, and scheduling of the Work.

§ 3.1.3.2 The Construction Manager shall advise the Owner and Architect on proposed site use and improvements, selection of materials, building systems, and equipment. The Construction Manager shall also provide recommendations to the Owner and Architect, consistent with the Project requirements, on constructability; availability of materials and labor; time requirements for procurement, installation and construction; prefabrication; and factors related to construction cost including, but not limited to, costs of alternative designs or materials, preliminary budgets, life-cycle data, and possible cost reductions. The Construction Manager shall consult with the Architect regarding professional services to be provided by the Construction Manager during the Construction Phase.

§ 3.1.3.3 The Construction Manager shall assist the Owner and Architect in establishing building information modeling and digital data protocols for the Project, using AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 3.1.4 Project Schedule

When Project requirements in Section 4.1.1 have been sufficiently identified, the Construction Manager shall prepare and periodically update a Project schedule for the Architect's review and the Owner's acceptance. The Construction Manager shall obtain the Architect's approval for the portion of the Project schedule relating to the performance of the Architect's services. The Project schedule shall coordinate and integrate the Construction Manager's services, the Architect's services, other Owner consultants' services, and the Owner's responsibilities; and identify items that affect the Project's timely completion. The updated Project schedule shall include the following: submission of the Guaranteed Maximum Price proposal; components of the Work; times of commencement and completion required of each Subcontractor; ordering and delivery of products, including those that must be ordered in advance of construction; and the occupancy requirements of the Owner.

§ 3.1.5 Phased Construction

The Construction Manager, in consultation with the Architect, shall provide recommendations with regard to accelerated or fast-track scheduling, procurement, and sequencing for phased construction. The Construction Manager shall take into consideration cost reductions, cost information, constructability, provisions for temporary facilities, and procurement and construction scheduling issues.

§ 3.1.6 Cost Estimates

§ 3.1.6.1 Based on the preliminary design and other design criteria prepared by the Architect, the Construction Manager shall prepare, for the Architect's review and the Owner's approval, preliminary estimates of the Cost of the Work or the cost of program requirements using area, volume, or similar conceptual estimating techniques. If the Architect or Construction Manager suggests alternative materials and systems, the Construction Manager shall provide cost evaluations of those alternative materials and systems.

§ 3.1.6.2 As the Architect progresses with the preparation of the Schematic Design, Design Development and Construction Documents, the Construction Manager shall prepare and update, at appropriate intervals agreed to by the Owner, Construction Manager and Architect, an estimate of the Cost of the Work with increasing detail and refinement. The Construction Manager shall include in the estimate those costs to allow for the further development of the design, price escalation, and market conditions, until such time as the Owner and Construction Manager agree on a Guaranteed Maximum Price for the Work. The estimate shall be provided for the Architect's review and the Owner's approval. The Construction Manager shall inform the Owner and Architect in the event that the estimate of the Cost of the Work exceeds the latest approved Project budget, and make recommendations for corrective action.

§ 3.1.6.3 If the Architect is providing cost estimating services as a Supplemental Service, and a discrepancy exists between the Construction Manager's cost estimates and the Architect's cost estimates, the Construction Manager and the Architect shall work together to reconcile the cost estimates.

§ 3.1.7 As the Architect progresses with the preparation of the Schematic Design, Design Development and Construction Documents, the Construction Manager shall consult with the Owner and Architect and make recommendations regarding constructability and schedules, for the Architect's review and the Owner's approval.

§ 3.1.8 The Construction Manager shall provide recommendations and information to the Owner and Architect regarding equipment, materials, services, and temporary Project facilities.

§ 3.1.9 The Construction Manager shall provide a staffing plan for Preconstruction Phase services for the Owner's review and approval.

§ 3.1.10 If the Owner identified a Sustainable Objective in Article 1, the Construction Manager shall fulfill its Preconstruction Phase responsibilities as required in AIA Document E234™-2019, Sustainable Projects Exhibit, Construction Manager as Constructor Edition, attached to this Agreement.

§ 3.1.11 Subcontractors and Suppliers

§ 3.1.11.1 If the Owner has provided requirements for subcontractor procurement in section 1.1.14, the Construction Manager shall provide a subcontracting plan, addressing the Owner's requirements, for the Owner's review and approval.

§ 3.1.11.2 The Construction Manager shall develop bidders' interest in the Project.

§ 3.1.11.3 The processes described in Article 9 shall apply if bid packages will be issued during the Preconstruction Phase.

§ 3.1.12 Procurement

The Construction Manager shall prepare, for the Architect's review and the Owner's acceptance, a procurement schedule for items that must be ordered in advance of construction. The Construction Manager shall expedite and coordinate the ordering and delivery of materials that must be ordered in advance of construction. If the Owner agrees to procure any items prior to the establishment of the Guaranteed Maximum Price, the Owner shall procure the items on terms and conditions acceptable to the Construction Manager. Upon the establishment of the Guaranteed Maximum Price, the Owner shall assign all contracts for these items to the Construction Manager and the Construction Manager shall thereafter accept responsibility for them.

§ 3.1.13 Compliance with Laws

The Construction Manager shall comply with applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to its performance under this Contract, and with equal employment opportunity programs, and other programs as may be required by governmental and quasi-governmental authorities.

§ 3.1.14 Other Preconstruction Services

Insert a description of any other Preconstruction Phase services to be provided by the Construction Manager, or reference an exhibit attached to this document

(Describe any other Preconstruction Phase services, such as providing cash flow projections, development of a project information management system, early selection or procurement of subcontractors, etc.)

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§ 3.2 Guaranteed Maximum Price Proposal

§ 3.2.1 At a time to be mutually agreed upon by the Owner and the Construction Manager, the Construction Manager shall prepare a Guaranteed Maximum Price proposal for the Owner's and Architect's review, and the Owner's acceptance. The Guaranteed Maximum Price in the proposal shall be the sum of the Construction Manager's estimate of the Cost of the Work, the Construction Manager's contingency described in Section 3.2.4, and the Construction Manager's Fee described in Section 6.1.2.

§ 3.2.2 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes, or equipment, all of which, if required, shall be incorporated by Change Order.

§ 3.2.3 The Construction Manager shall include with the Guaranteed Maximum Price proposal a written statement of its basis, which shall include the following:

- .1 A list of the Drawings and Specifications, including all Addenda thereto, and the Conditions of the Contract;
- .2 A list of the clarifications and assumptions made by the Construction Manager in the preparation of the Guaranteed Maximum Price proposal, including assumptions under Section 3.2.2;
- .3 A statement of the proposed Guaranteed Maximum Price, including a statement of the estimated Cost of the Work organized by trade categories or systems, including allowances; the Construction Manager's contingency set forth in Section 3.2.4; and the Construction Manager's Fee;
- .4 The anticipated date of Substantial Completion upon which the proposed Guaranteed Maximum Price is based; and
- .5 A date by which the Owner must accept the Guaranteed Maximum Price.

§ 3.2.4 In preparing the Construction Manager's Guaranteed Maximum Price proposal, the Construction Manager shall include a contingency for the Construction Manager's exclusive use to cover those costs that are included in the Guaranteed Maximum Price but not otherwise allocated to another line item or included in a Change Order.

§ 3.2.5 The Construction Manager shall meet with the Owner and Architect to review the Guaranteed Maximum Price proposal. In the event that the Owner or Architect discover any inconsistencies or inaccuracies in the information presented, they shall promptly notify the Construction Manager, who shall make appropriate adjustments to the Guaranteed Maximum Price proposal, its basis, or both.

§ 3.2.6 If the Owner notifies the Construction Manager that the Owner has accepted the Guaranteed Maximum Price proposal in writing before the date specified in the Guaranteed Maximum Price proposal, the Guaranteed Maximum Price proposal shall be deemed effective without further acceptance from the Construction Manager. Following acceptance of a Guaranteed Maximum Price, the Owner and Construction Manager shall execute the Guaranteed Maximum Price Amendment amending this Agreement, a copy of which the Owner shall provide to the Architect. The Guaranteed Maximum Price Amendment shall set forth the agreed upon Guaranteed Maximum Price with the information and assumptions upon which it is based.

§ 3.2.7 The Construction Manager shall not incur any cost to be reimbursed as part of the Cost of the Work prior to the execution of the Guaranteed Maximum Price Amendment, unless the Owner provides prior written authorization for such costs.

§ 3.2.8 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions and clarifications contained in the Guaranteed Maximum Price Amendment. The Owner shall promptly furnish such revised Contract Documents to the Construction Manager. The Construction Manager shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions and clarifications contained in the Guaranteed Maximum Price Amendment and the revised Contract Documents.

§ 3.2.9 The Construction Manager shall include in the Guaranteed Maximum Price all sales, consumer, use and similar taxes for the Work provided by the Construction Manager that are legally enacted, whether or not yet effective, at the time the Guaranteed Maximum Price Amendment is executed.

§ 3.3 Construction Phase

§ 3.3.1 General

§ 3.3.1.1 For purposes of Section 8.1.2 of A201–2017, the date of commencement of the Work shall mean the date of commencement of the Construction Phase.

§ 3.3.1.2 The Construction Phase shall commence upon the Owner's execution of the Guaranteed Maximum Price Amendment or, prior to acceptance of the Guaranteed Maximum Price proposal, by written agreement of the parties. The

written agreement shall set forth a description of the Work to be performed by the Construction Manager, and any insurance and bond requirements for Work performed prior to execution of the Guaranteed Maximum Price Amendment.

§ 3.3.2 Administration

§ 3.3.2.1 The Construction Manager shall schedule and conduct meetings to discuss such matters as procedures, progress, coordination, scheduling, and status of the Work. The Construction Manager shall prepare and promptly distribute minutes of the meetings to the Owner and Architect.

§ 3.3.2.2 Upon the execution of the Guaranteed Maximum Price Amendment, the Construction Manager shall prepare and submit to the Owner and Architect a construction schedule for the Work and a submittal schedule in accordance with Section 3.10 of A201–2017.

§ 3.3.2.3 Monthly Report

The Construction Manager shall record the progress of the Project. On a monthly basis, or otherwise as agreed to by the Owner, the Construction Manager shall submit written progress reports to the Owner and Architect, showing percentages of completion and other information required by the Owner.

§ 3.3.2.4 Daily Logs

The Construction Manager shall keep, and make available to the Owner and Architect, a daily log containing a record for each day of weather, portions of the Work in progress, number of workers on site, identification of equipment on site, problems that might affect progress of the work, accidents, injuries, and other information required by the Owner.

§ 3.3.2.5 Cost Control

The Construction Manager shall develop a system of cost control for the Work, including regular monitoring of actual costs for activities in progress and estimates for uncompleted tasks and proposed changes. The Construction Manager shall identify variances between actual and estimated costs and report the variances to the Owner and Architect, and shall provide this information in its monthly reports to the Owner and Architect, in accordance with Section 3.3.2.3 above.

ARTICLE 4 OWNER'S RESPONSIBILITIES

§ 4.1 Information and Services Required of the Owner

§ 4.1.1 The Owner shall provide information with reasonable promptness, regarding requirements for and limitations on the Project, including a written program which shall set forth the Owner's objectives, constraints, and criteria, including schedule, space requirements and relationships, flexibility and expandability, special equipment, systems, sustainability and site requirements.

§ 4.1.2 Prior to the execution of the Guaranteed Maximum Price Amendment, the Construction Manager may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. After execution of the Guaranteed Maximum Price Amendment, the Construction Manager may request such information as set forth in A201-2017 Section 2.2.

§ 4.1.3 The Owner shall establish and periodically update the Owner's budget for the Project, including (1) the budget for the Cost of the Work as defined in Article 7, (2) the Owner's other costs, and (3) reasonable contingencies related to all of these costs. If the Owner significantly increases or decreases the Owner's budget for the Cost of the Work, the Owner shall notify the Construction Manager and Architect. The Owner and the Architect, in consultation with the Construction Manager, shall thereafter agree to a corresponding change in the Project's scope and quality.

§ 4.1.4 Structural and Environmental Tests, Surveys and Reports. During the Preconstruction Phase, the Owner shall furnish the following information or services with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Construction Manager's performance of the Work with reasonable promptness after receiving the Construction Manager's written request for such information or services. The Construction Manager shall be entitled to rely on the accuracy of information and services furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 4.1.4.1 The Owner shall furnish tests, inspections, and reports, required by law and as otherwise agreed to by the parties, such as structural, mechanical, and chemical tests, tests for air and water pollution, and tests for hazardous materials.

§ 4.1.4.2 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a written legal description of the site. The surveys and legal information shall include, as applicable, grades and lines of streets, alleys, pavements and adjoining property and structures; designated wetlands; adjacent drainage; rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, boundaries and contours of the site; locations, dimensions and other necessary data with respect to existing buildings, other improvements and trees; and information concerning available utility services and lines, both public and private, above and below grade, including inverts and depths. All the information on the survey shall be referenced to a Project benchmark.

§ 4.1.4.3 The Owner, when such services are requested, shall furnish services of geotechnical engineers, which may include test borings, test pits, determinations of soil bearing values, percolation tests, evaluations of hazardous materials, seismic evaluation, ground corrosion tests and resistivity tests, including necessary operations for anticipating subsoil conditions, with written reports and appropriate recommendations.

§ 4.1.5 During the Construction Phase, the Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Construction Manager's performance of the Work with reasonable promptness after receiving the Construction Manager's written request for such information or services.

§ 4.1.6 If the Owner identified a Sustainable Objective in Article 1, the Owner shall fulfill its responsibilities as required in AIA Document E234™–2019, Sustainable Projects Exhibit, Construction Manager as Constructor Edition, attached to this Agreement.

§ 4.2 Owner's Designated Representative

The Owner shall identify a representative authorized to act on behalf of the Owner with respect to the Project. The Owner's representative shall render decisions promptly and furnish information expeditiously, so as to avoid unreasonable delay in the services or Work of the Construction Manager. Except as otherwise provided in Section 4.2.1 of A201–2017, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 4.2.1 Legal Requirements. The Owner shall furnish all legal, insurance and accounting services, including auditing services, that may be reasonably necessary at any time for the Project to meet the Owner's needs and interests.

§ 4.3 Architect

The Owner shall retain an Architect to provide services, duties and responsibilities as described in AIA Document B133™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Constructor Edition, including any additional services requested by the Construction Manager that are necessary for the Preconstruction and Construction Phase services under this Agreement. The Owner shall provide the Construction Manager with a copy of the scope of services in the executed agreement between the Owner and the Architect, and any further modifications to the Architect's scope of services in the agreement.

ARTICLE 5 COMPENSATION AND PAYMENTS FOR PRECONSTRUCTION PHASE SERVICES

§ 5.1 Compensation

§ 5.1.1 For the Construction Manager's Preconstruction Phase services described in Sections 3.1 and 3.2, the Owner shall compensate the Construction Manager as follows:

(Insert amount of, or basis for, compensation and include a list of reimbursable cost items, as applicable.)

« »

§ 5.1.2 The hourly billing rates for Preconstruction Phase services of the Construction Manager and the Construction Manager's Consultants and Subcontractors, if any, are set forth below.

(If applicable, attach an exhibit of hourly billing rates or insert them below.)

« »

Individual or Position

Rate

§ 5.1.2.1 Hourly billing rates for Preconstruction Phase services include all costs to be paid or incurred by the Construction Manager, as required by law or collective bargaining agreements, for taxes, insurance, contributions, assessments and benefits and, for personnel not covered by collective bargaining agreements, customary benefits such as sick leave, medical and health benefits, holidays, vacations and pensions, and shall remain unchanged unless the parties execute a Modification.

§ 5.1.3 If the Preconstruction Phase services covered by this Agreement have not been completed within « » (« ») months of the date of this Agreement, through no fault of the Construction Manager, the Construction Manager's compensation for Preconstruction Phase services shall be equitably adjusted.

§ 5.2 Payments

§ 5.2.1 Unless otherwise agreed, payments for services shall be made monthly in proportion to services performed.

§ 5.2.2 Payments are due and payable upon presentation of the Construction Manager's invoice. Amounts unpaid « » (« ») days after the invoice date shall bear interest at the rate entered below, or in the absence thereof at the legal rate prevailing from time to time at the principal place of business of the Construction Manager.
(Insert rate of monthly or annual interest agreed upon.)

« » % « »

ARTICLE 6 COMPENSATION FOR CONSTRUCTION PHASE SERVICES

§ 6.1 Contract Sum

§ 6.1.1 The Owner shall pay the Construction Manager the Contract Sum in current funds for the Construction Manager's performance of the Contract after execution of the Guaranteed Maximum Price Amendment. The Contract Sum is the Cost of the Work as defined in Article 7 plus the Construction Manager's Fee.

§ 6.1.2 The Construction Manager's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Construction Manager's Fee.)

« »

§ 6.1.3 The method of adjustment of the Construction Manager's Fee for changes in the Work:

« »

§ 6.1.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

« »

§ 6.1.5 Rental rates for Construction Manager-owned equipment shall not exceed « » percent (« » %) of the standard rental rate paid at the place of the Project.

§ 6.1.6 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

« »

§ 6.1.7 Other:

(Insert provisions for bonus, cost savings or other incentives, if any, that might result in a change to the Contract Sum.)

« »

§ 6.2 Guaranteed Maximum Price

The Construction Manager guarantees that the Contract Sum shall not exceed the Guaranteed Maximum Price set forth in the Guaranteed Maximum Price Amendment, subject to additions and deductions by Change Order as provided in the Contract Documents. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Construction Manager without reimbursement by the Owner.

§ 6.3 Changes in the Work

§ 6.3.1 The Owner may, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions. The Owner shall issue such changes in writing. The Construction Manager may be entitled to an equitable adjustment in the Contract Time as a result of changes in the Work.

§ 6.3.1.1 The Architect may order minor changes in the Work as provided in Article 7 of AIA Document A201–2017, General Conditions of the Contract for Construction.

§ 6.3.2 Adjustments to the Guaranteed Maximum Price on account of changes in the Work subsequent to the execution of the Guaranteed Maximum Price Amendment may be determined by any of the methods listed in Article 7 of AIA Document A201–2017, General Conditions of the Contract for Construction.

§ 6.3.3 Adjustments to subcontracts awarded on the basis of a stipulated sum shall be determined in accordance with Article 7 of A201–2017, as they refer to “cost” and “fee,” and not by Articles 6 and 7 of this Agreement. Adjustments to subcontracts awarded with the Owner’s prior written consent on the basis of cost plus a fee shall be calculated in accordance with the terms of those subcontracts.

§ 6.3.4 In calculating adjustments to the Guaranteed Maximum Price, the terms “cost” and “costs” as used in Article 7 of AIA Document A201–2017 shall mean the Cost of the Work as defined in Article 7 of this Agreement and the term “fee” shall mean the Construction Manager’s Fee as defined in Section 6.1.2 of this Agreement.

§ 6.3.5 If no specific provision is made in Section 6.1.3 for adjustment of the Construction Manager’s Fee in the case of changes in the Work, or if the extent of such changes is such, in the aggregate, that application of the adjustment provisions of Section 6.1.3 will cause substantial inequity to the Owner or Construction Manager, the Construction Manager’s Fee shall be equitably adjusted on the same basis that was used to establish the Fee for the original Work, and the Guaranteed Maximum Price shall be adjusted accordingly.

ARTICLE 7 COST OF THE WORK FOR CONSTRUCTION PHASE

§ 7.1 Costs to Be Reimbursed

§ 7.1.1 The term Cost of the Work shall mean costs necessarily incurred by the Construction Manager in the proper performance of the Work. The Cost of the Work shall include only the items set forth in Sections 7.1 through 7.7.

§ 7.1.2 Where, pursuant to the Contract Documents, any cost is subject to the Owner’s prior approval, the Construction Manager shall obtain such approval in writing prior to incurring the cost.

§ 7.1.3 Costs shall be at rates not higher than the standard rates paid at the place of the Project, except with prior approval of the Owner.

§ 7.2 Labor Costs

§ 7.2.1 Wages or salaries of construction workers directly employed by the Construction Manager to perform the construction of the Work at the site or, with the Owner’s prior approval, at off-site workshops.

§ 7.2.2 Wages or salaries of the Construction Manager’s supervisory and administrative personnel when stationed at the site and performing Work, with the Owner’s prior approval.

§ 7.2.2.1 Wages or salaries of the Construction Manager’s supervisory and administrative personnel when performing Work and stationed at a location other than the site, but only for that portion of time required for the Work, and limited to the personnel and activities listed below:

(Identify the personnel, type of activity and, if applicable, any agreed upon percentage of time to be devoted to the Work.)

« »

§ 7.2.3 Wages and salaries of the Construction Manager’s supervisory or administrative personnel engaged at factories, workshops or while traveling, in expediting the production or transportation of materials or equipment required for the Work, but only for that portion of their time required for the Work.

§ 7.2.4 Costs paid or incurred by the Construction Manager, as required by law or collective bargaining agreements, for taxes, insurance, contributions, assessments and benefits and, for personnel not covered by collective bargaining agreements, customary benefits such as sick leave, medical and health benefits, holidays, vacations and pensions, provided such costs are based on wages and salaries included in the Cost of the Work under Sections 7.2.1 through 7.2.3.

§ 7.2.5 If agreed rates for labor costs, in lieu of actual costs, are provided in this Agreement, the rates shall remain unchanged throughout the duration of this Agreement, unless the parties execute a Modification.

§ 7.3 Subcontract Costs

Payments made by the Construction Manager to Subcontractors in accordance with the requirements of the subcontracts and this Agreement.

§ 7.4 Costs of Materials and Equipment Incorporated in the Completed Construction

§ 7.4.1 Costs, including transportation and storage at the site, of materials and equipment incorporated, or to be incorporated, in the completed construction.

§ 7.4.2 Costs of materials described in the preceding Section 7.4.1 in excess of those actually installed to allow for reasonable waste and spoilage. Unused excess materials, if any, shall become the Owner's property at the completion of the Work or, at the Owner's option, shall be sold by the Construction Manager. Any amounts realized from such sales shall be credited to the Owner as a deduction from the Cost of the Work.

§ 7.5 Costs of Other Materials and Equipment, Temporary Facilities and Related Items

§ 7.5.1 Costs of transportation, storage, installation, dismantling, maintenance, and removal of materials, supplies, temporary facilities, machinery, equipment and hand tools not customarily owned by construction workers that are provided by the Construction Manager at the site and fully consumed in the performance of the Work. Costs of materials, supplies, temporary facilities, machinery, equipment, and tools, that are not fully consumed, shall be based on the cost or value of the item at the time it is first used on the Project site less the value of the item when it is no longer used at the Project site. Costs for items not fully consumed by the Construction Manager shall mean fair market value.

§ 7.5.2 Rental charges for temporary facilities, machinery, equipment, and hand tools not customarily owned by construction workers that are provided by the Construction Manager at the site, and the costs of transportation, installation, dismantling, minor repairs, and removal of such temporary facilities, machinery, equipment, and hand tools. Rates and quantities of equipment owned by the Construction Manager, or a related party as defined in Section 7.8, shall be subject to the Owner's prior approval. The total rental cost of any such equipment may not exceed the purchase price of any comparable item.

§ 7.5.3 Costs of removal of debris from the site of the Work and its proper and legal disposal.

§ 7.5.4 Costs of the Construction Manager's site office, including general office equipment and supplies.

§ 7.5.5 Costs of materials and equipment suitably stored off the site at a mutually acceptable location, subject to the Owner's prior approval.

§ 7.6 Miscellaneous Costs

§ 7.6.1 Premiums for that portion of insurance and bonds required by the Contract Documents that can be directly attributed to this Contract.

§ 7.6.1.1 Costs for self-insurance, for either full or partial amounts of the coverages required by the Contract Documents, with the Owner's prior approval.

§ 7.6.1.2 Costs for insurance through a captive insurer owned or controlled by the Construction Manager, with the Owner's prior approval.

§ 7.6.2 Sales, use, or similar taxes, imposed by a governmental authority, that are related to the Work and for which the Construction Manager is liable.

§ 7.6.3 Fees and assessments for the building permit, and for other permits, licenses, and inspections, for which the Construction Manager is required by the Contract Documents to pay.

§ 7.6.4 Fees of laboratories for tests required by the Contract Documents; except those related to defective or nonconforming Work for which reimbursement is excluded under Article 13 of AIA Document A201–2017 or by other provisions of the Contract Documents, and which do not fall within the scope of Section 7.7.3.

§ 7.6.5 Royalties and license fees paid for the use of a particular design, process, or product, required by the Contract Documents.

§ 7.6.5.1 The cost of defending suits or claims for infringement of patent rights arising from requirements of the Contract Documents, payments made in accordance with legal judgments against the Construction Manager resulting from such suits or claims, and payments of settlements made with the Owner's consent, unless the Construction Manager had reason to believe that the required design, process, or product was an infringement of a copyright or a patent, and the Construction Manager failed to promptly furnish such information to the Architect as required by Article 3 of AIA Document A201–2017. The costs of legal defenses, judgments, and settlements shall not be included in the Cost of the Work used to calculate the Construction Manager's Fee or subject to the Guaranteed Maximum Price.

§ 7.6.6 Costs for communications services, electronic equipment, and software, directly related to the Work and located at the site, with the Owner's prior approval.

§ 7.6.7 Costs of document reproductions and delivery charges.

§ 7.6.8 Deposits lost for causes other than the Construction Manager's negligence or failure to fulfill a specific responsibility in the Contract Documents.

§ 7.6.9 Legal, mediation and arbitration costs, including attorneys' fees, other than those arising from disputes between the Owner and Construction Manager, reasonably incurred by the Construction Manager after the execution of this Agreement in the performance of the Work and with the Owner's prior approval, which shall not be unreasonably withheld.

§ 7.6.10 Expenses incurred in accordance with the Construction Manager's standard written personnel policy for relocation and temporary living allowances of the Construction Manager's personnel required for the Work, with the Owner's prior approval.

§ 7.6.11 That portion of the reasonable expenses of the Construction Manager's supervisory or administrative personnel incurred while traveling in discharge of duties connected with the Work.

§ 7.7 Other Costs and Emergencies

§ 7.7.1 Other costs incurred in the performance of the Work, with the Owner's prior approval.

§ 7.7.2 Costs incurred in taking action to prevent threatened damage, injury, or loss, in case of an emergency affecting the safety of persons and property, as provided in Article 10 of AIA Document A201–2017.

§ 7.7.3 Costs of repairing or correcting damaged or nonconforming Work executed by the Construction Manager, Subcontractors, or suppliers, provided that such damaged or nonconforming Work was not caused by the negligence of, or failure to fulfill a specific responsibility by, the Construction Manager, and only to the extent that the cost of repair or correction is not recovered by the Construction Manager from insurance, sureties, Subcontractors, suppliers, or others.

§ 7.7.4 The costs described in Sections 7.1 through 7.7 shall be included in the Cost of the Work, notwithstanding any provision of AIA Document A201–2017 or other Conditions of the Contract which may require the Construction Manager to pay such costs, unless such costs are excluded by the provisions of Section 7.9.

§ 7.8 Related Party Transactions

§ 7.8.1 For purposes of this Section 7.8, the term "related party" shall mean (1) a parent, subsidiary, affiliate, or other entity having common ownership of, or sharing common management with, the Construction Manager; (2) any entity in which any stockholder in, or management employee of, the Construction Manager holds an equity interest in excess of ten percent in the aggregate; (3) any entity which has the right to control the business or affairs of the Construction Manager;

or (4) any person, or any member of the immediate family of any person, who has the right to control the business or affairs of the Construction Manager.

§ 7.8.2 If any of the costs to be reimbursed arise from a transaction between the Construction Manager and a related party, the Construction Manager shall notify the Owner of the specific nature of the contemplated transaction, including the identity of the related party and the anticipated cost to be incurred, before any such transaction is consummated or cost incurred. If the Owner, after such notification, authorizes the proposed transaction in writing, then the cost incurred shall be included as a cost to be reimbursed, and the Construction Manager shall procure the Work, equipment, goods, or service, from the related party, as a Subcontractor, according to the terms of Article 9. If the Owner fails to authorize the transaction in writing, the Construction Manager shall procure the Work, equipment, goods, or service from some person or entity other than a related party according to the terms of Article 9.

§ 7.9 Costs Not To Be Reimbursed

§ 7.9.1 The Cost of the Work shall not include the items listed below:

- .1 Salaries and other compensation of the Construction Manager's personnel stationed at the Construction Manager's principal office or offices other than the site office, except as specifically provided in Section 7.2, or as may be provided in Article 14;
- .2 Bonuses, profit sharing, incentive compensation, and any other discretionary payments, paid to anyone hired by the Construction Manager or paid to any Subcontractor or vendor, unless the Owner has provided prior approval;
- .3 Expenses of the Construction Manager's principal office and offices other than the site office;
- .4 Overhead and general expenses, except as may be expressly included in Sections 7.1 to 7.7;
- .5 The Construction Manager's capital expenses, including interest on the Construction Manager's capital employed for the Work;
- .6 Except as provided in Section 7.7.3 of this Agreement, costs due to the negligence of, or failure to fulfill a specific responsibility of the Contract by, the Construction Manager, Subcontractors, and suppliers, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable;
- .7 Any cost not specifically and expressly described in Sections 7.1 to 7.7;
- .8 Costs, other than costs included in Change Orders approved by the Owner, that would cause the Guaranteed Maximum Price to be exceeded; and
- .9 Costs for services incurred during the Preconstruction Phase.

ARTICLE 8 DISCOUNTS, REBATES, AND REFUNDS

§ 8.1 Cash discounts obtained on payments made by the Construction Manager shall accrue to the Owner if (1) before making the payment, the Construction Manager included the amount to be paid, less such discount, in an Application for Payment and received payment from the Owner, or (2) the Owner has deposited funds with the Construction Manager with which to make payments; otherwise, cash discounts shall accrue to the Construction Manager. Trade discounts, rebates, refunds, and amounts received from sales of surplus materials and equipment shall accrue to the Owner, and the Construction Manager shall make provisions so that they can be obtained.

§ 8.2 Amounts that accrue to the Owner in accordance with the provisions of Section 8.1 shall be credited to the Owner as a deduction from the Cost of the Work.

ARTICLE 9 SUBCONTRACTS AND OTHER AGREEMENTS

§ 9.1 Those portions of the Work that the Construction Manager does not customarily perform with the Construction Manager's own personnel shall be performed under subcontracts or other appropriate agreements with the Construction Manager. The Owner may designate specific persons from whom, or entities from which, the Construction Manager shall obtain bids. The Construction Manager shall obtain bids from Subcontractors, and from suppliers of materials or equipment fabricated especially for the Work, who are qualified to perform that portion of the Work in accordance with the requirements of the Contract Documents. The Construction Manager shall deliver such bids to the Architect and Owner with an indication as to which bids the Construction Manager intends to accept. The Owner then has the right to review the Construction Manager's list of proposed subcontractors and suppliers in consultation with the Architect and, subject to Section 9.1.1, to object to any subcontractor or supplier. Any advice of the Architect, or approval or objection by the Owner, shall not relieve the Construction Manager of its responsibility to perform the Work in accordance with the Contract Documents. The Construction Manager shall not be required to contract with anyone to whom the Construction Manager has reasonable objection.

§ 9.1.1 When a specific subcontractor or supplier (1) is recommended to the Owner by the Construction Manager; (2) is qualified to perform that portion of the Work; and (3) has submitted a bid that conforms to the requirements of the Contract Documents without reservations or exceptions, but the Owner requires that another bid be accepted, then the Construction Manager may require that a Change Order be issued to adjust the Guaranteed Maximum Price by the difference between the bid of the person or entity recommended to the Owner by the Construction Manager and the amount of the subcontract or other agreement actually signed with the person or entity designated by the Owner.

§ 9.2 Subcontracts or other agreements shall conform to the applicable payment provisions of this Agreement, and shall not be awarded on the basis of cost plus a fee without the Owner's prior written approval. If a subcontract is awarded on the basis of cost plus a fee, the Construction Manager shall provide in the subcontract for the Owner to receive the same audit rights with regard to the Subcontractor as the Owner receives with regard to the Construction Manager in Article 10.

ARTICLE 10 ACCOUNTING RECORDS

The Construction Manager shall keep full and detailed records and accounts related to the Cost of the Work, and exercise such controls, as may be necessary for proper financial management under this Contract and to substantiate all costs incurred. The accounting and control systems shall be satisfactory to the Owner. The Owner and the Owner's auditors shall, during regular business hours and upon reasonable notice, be afforded access to, and shall be permitted to audit and copy, the Construction Manager's records and accounts, including complete documentation supporting accounting entries, books, job cost reports, correspondence, instructions, drawings, receipts, subcontracts, Subcontractor's proposals, Subcontractor's invoices, purchase orders, vouchers, memoranda, and other data relating to this Contract. The Construction Manager shall preserve these records for a period of three years after final payment, or for such longer period as may be required by law.

ARTICLE 11 PAYMENTS FOR CONSTRUCTION PHASE SERVICES

§ 11.1 Progress Payments

§ 11.1.1 Based upon Applications for Payment submitted to the Architect by the Construction Manager, and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum, to the Construction Manager, as provided below and elsewhere in the Contract Documents.

§ 11.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 11.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the amount certified to the Construction Manager not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 11.1.4 With each Application for Payment, the Construction Manager shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner or Architect to demonstrate that payments already made by the Construction Manager on account of the Cost of the Work equal or exceed progress payments already received by the Construction Manager, plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Construction Manager's Fee.

§ 11.1.5 Each Application for Payment shall be based on the most recent schedule of values submitted by the Construction Manager in accordance with the Contract Documents. The schedule of values shall allocate the entire Guaranteed Maximum Price among: (1) the various portions of the Work; (2) any contingency for costs that are included in the Guaranteed Maximum Price but not otherwise allocated to another line item or included in a Change Order; and (3) the Construction Manager's Fee.

§ 11.1.5.1 The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. The schedule of values shall be used as a basis for reviewing the Construction Manager's Applications for Payment.

§ 11.1.5.2 The allocation of the Guaranteed Maximum Price under this Section 11.1.5 shall not constitute a separate guaranteed maximum price for the Cost of the Work of each individual line item in the schedule of values.

§ 11.1.5.3 When the Construction Manager allocates costs from a contingency to another line item in the schedule of values, the Construction Manager shall submit supporting documentation to the Architect.

§ 11.1.6 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage of completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed, or (2) the percentage obtained by dividing (a) the expense that has actually been incurred by the Construction Manager on account of that portion of the Work and for which the Construction Manager has made payment or intends to make payment prior to the next Application for Payment, by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

§ 11.1.7 In accordance with AIA Document A201–2017 and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 11.1.7.1 The amount of each progress payment shall first include:

- .1 That portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the most recent schedule of values;
- .2 That portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction or, if approved in writing in advance by the Owner, suitably stored off the site at a location agreed upon in writing;
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified; and
- .4 The Construction Manager's Fee, computed upon the Cost of the Work described in the preceding Sections 11.1.7.1.1 and 11.1.7.1.2 at the rate stated in Section 6.1.2 or, if the Construction Manager's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum fee as the Cost of the Work included in Sections 11.1.7.1.1 and 11.1.7.1.2 bears to a reasonable estimate of the probable Cost of the Work upon its completion.

§ 11.1.7.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Construction Manager does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Construction Manager intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017;
- .5 The shortfall, if any, indicated by the Construction Manager in the documentation required by Section 11.1.4 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and
- .6 Retainage withheld pursuant to Section 11.1.8.

§ 11.1.8 Retainage

§ 11.1.8.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« »

§ 11.1.8.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 11.1.8.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 11.1.8.1 is to be modified prior to Substantial Completion of the entire Work, insert provisions for such modification.)

« »

§ 11.1.8.3 Except as set forth in this Section 11.1.8.3, upon Substantial Completion of the Work, the Construction Manager may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 11.1.8. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

(Insert any other conditions for release of retainage, such as upon completion of the Owner's audit and reconciliation, upon Substantial Completion.)

« »

§ 11.1.9 If final completion of the Work is materially delayed through no fault of the Construction Manager, the Owner shall pay the Construction Manager any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 11.1.10 Except with the Owner's prior written approval, the Construction Manager shall not make advance payments to suppliers for materials or equipment which have not been delivered and suitably stored at the site.

§ 11.1.11 The Owner and the Construction Manager shall agree upon a mutually acceptable procedure for review and approval of payments to Subcontractors, and the percentage of retainage held on Subcontracts, and the Construction Manager shall execute subcontracts in accordance with those agreements.

§ 11.1.12 In taking action on the Construction Manager's Applications for Payment the Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Construction Manager, and such action shall not be deemed to be a representation that (1) the Architect has made a detailed examination, audit, or arithmetic verification, of the documentation submitted in accordance with Section 11.1.4 or other supporting data; (2) that the Architect has made exhaustive or continuous on-site inspections; or (3) that the Architect has made examinations to ascertain how or for what purposes the Construction Manager has used amounts previously paid on account of the Contract. Such examinations, audits, and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 11.2 Final Payment

§ 11.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Construction Manager when

- .1 the Construction Manager has fully performed the Contract, except for the Construction Manager's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 the Construction Manager has submitted a final accounting for the Cost of the Work and a final Application for Payment; and
- .3 a final Certificate for Payment has been issued by the Architect in accordance with Section 11.2.2.2.

§ 11.2.2 Within 30 days of the Owner's receipt of the Construction Manager's final accounting for the Cost of the Work, the Owner shall conduct an audit of the Cost of the Work or notify the Architect that it will not conduct an audit.

§ 11.2.2.1 If the Owner conducts an audit of the Cost of the Work, the Owner shall, within 10 days after completion of the audit, submit a written report based upon the auditors' findings to the Architect.

§ 11.2.2.2 Within seven days after receipt of the written report described in Section 11.2.2.1, or receipt of notice that the Owner will not conduct an audit, and provided that the other conditions of Section 11.2.1 have been met, the Architect will either issue to the Owner a final Certificate for Payment with a copy to the Construction Manager, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding a certificate as provided in Article 9 of AIA Document A201–2017. The time periods stated in this Section 11.2.2 supersede those stated in Article 9 of AIA

Document A201–2017. The Architect is not responsible for verifying the accuracy of the Construction Manager’s final accounting.

§ 11.2.2.3 If the Owner’s auditors’ report concludes that the Cost of the Work, as substantiated by the Construction Manager’s final accounting, is less than claimed by the Construction Manager, the Construction Manager shall be entitled to request mediation of the disputed amount without seeking an initial decision pursuant to Article 15 of AIA Document A201–2017. A request for mediation shall be made by the Construction Manager within 30 days after the Construction Manager’s receipt of a copy of the Architect’s final Certificate for Payment. Failure to request mediation within this 30-day period shall result in the substantiated amount reported by the Owner’s auditors becoming binding on the Construction Manager. Pending a final resolution of the disputed amount, the Owner shall pay the Construction Manager the amount certified in the Architect’s final Certificate for Payment.

§ 11.2.3 The Owner’s final payment to the Construction Manager shall be made no later than 30 days after the issuance of the Architect’s final Certificate for Payment, or as follows:

« »

§ 11.2.4 If, subsequent to final payment, and at the Owner’s request, the Construction Manager incurs costs, described in Sections 7.1 through 7.7, and not excluded by Section 7.9, to correct defective or nonconforming Work, the Owner shall reimburse the Construction Manager for such costs, and the Construction Manager’s Fee applicable thereto, on the same basis as if such costs had been incurred prior to final payment, but not in excess of the Guaranteed Maximum Price. If adjustments to the Contract Sum are provided for in Section 6.1.7, the amount of those adjustments shall be recalculated, taking into account any reimbursements made pursuant to this Section 11.2.4 in determining the net amount to be paid by the Owner to the Construction Manager.

§ 11.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

« » % « »

ARTICLE 12 DISPUTE RESOLUTION

§ 12.1 Initial Decision Maker

§ 12.1.1 Any Claim between the Owner and Construction Manager shall be resolved in accordance with the provisions set forth in this Article 12 and Article 15 of A201–2017. However, for Claims arising from or relating to the Construction Manager’s Preconstruction Phase services, no decision by the Initial Decision Maker shall be required as a condition precedent to mediation or binding dispute resolution, and Section 12.1.2 of this Agreement shall not apply.

§ 12.1.2 The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017 for Claims arising from or relating to the Construction Manager’s Construction Phase services, unless the parties appoint below another individual, not a party to the Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »

« »

« »

« »

§ 12.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

[« »] Arbitration pursuant to Article 15 of AIA Document A201–2017

[« »] Litigation in a court of competent jurisdiction

[« »] Other: *(Specify)*

« »

If the Owner and Construction Manager do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 13 TERMINATION OR SUSPENSION

§ 13.1 Termination Prior to Execution of the Guaranteed Maximum Price Amendment

§ 13.1.1 If the Owner and the Construction Manager do not reach an agreement on the Guaranteed Maximum Price, the Owner may terminate this Agreement upon not less than seven days' written notice to the Construction Manager, and the Construction Manager may terminate this Agreement, upon not less than seven days' written notice to the Owner.

§ 13.1.2 In the event of termination of this Agreement pursuant to Section 13.1.1, the Construction Manager shall be compensated for Preconstruction Phase services and Work performed prior to receipt of a notice of termination, in accordance with the terms of this Agreement. In no event shall the Construction Manager's compensation under this Section exceed the compensation set forth in Section 5.1.

§ 13.1.3 Prior to the execution of the Guaranteed Maximum Price Amendment, the Owner may terminate this Agreement upon not less than seven days' written notice to the Construction Manager for the Owner's convenience and without cause, and the Construction Manager may terminate this Agreement, upon not less than seven days' written notice to the Owner, for the reasons set forth in Article 14 of A201–2017.

§ 13.1.4 In the event of termination of this Agreement pursuant to Section 13.1.3, the Construction Manager shall be equitably compensated for Preconstruction Phase services and Work performed prior to receipt of a notice of termination. In no event shall the Construction Manager's compensation under this Section exceed the compensation set forth in Section 5.1.

§ 13.1.5 If the Owner terminates the Contract pursuant to Section 13.1.3 after the commencement of the Construction Phase but prior to the execution of the Guaranteed Maximum Price Amendment, the Owner shall pay to the Construction Manager an amount calculated as follows, which amount shall be in addition to any compensation paid to the Construction Manager under Section 13.1.4:

- .1 Take the Cost of the Work incurred by the Construction Manager to the date of termination;
- .2 Add the Construction Manager's Fee computed upon the Cost of the Work to the date of termination at the rate stated in Section 6.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion; and
- .3 Subtract the aggregate of previous payments made by the Owner for Construction Phase services.

§ 13.1.6 The Owner shall also pay the Construction Manager fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Construction Manager that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 13.1.5.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Construction Manager shall, as a condition of receiving the payments referred to in this Article 13, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Construction Manager, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Construction Manager under such subcontracts or purchase orders. All Subcontracts, purchase orders and rental agreements entered into by the Construction Manager will contain provisions allowing for assignment to the Owner as described above.

§ 13.1.6.1 If the Owner accepts assignment of subcontracts, purchase orders or rental agreements as described above, the Owner will reimburse or indemnify the Construction Manager for all costs arising under the subcontract, purchase order or rental agreement, if those costs would have been reimbursable as Cost of the Work if the contract had not been terminated. If the Owner chooses not to accept assignment of any subcontract, purchase order or rental agreement that would have constituted a Cost of the Work had this agreement not been terminated, the Construction Manager will

terminate the subcontract, purchase order or rental agreement and the Owner will pay the Construction Manager the costs necessarily incurred by the Construction Manager because of such termination.

§ 13.2 Termination or Suspension Following Execution of the Guaranteed Maximum Price Amendment

§ 13.2.1 Termination

The Contract may be terminated by the Owner or the Construction Manager as provided in Article 14 of AIA Document A201–2017.

§ 13.2.2 Termination by the Owner for Cause

§ 13.2.2.1 If the Owner terminates the Contract for cause as provided in Article 14 of AIA Document A201–2017, the amount, if any, to be paid to the Construction Manager under Article 14 of AIA Document A201–2017 shall not cause the Guaranteed Maximum Price to be exceeded, nor shall it exceed an amount calculated as follows:

- .1** Take the Cost of the Work incurred by the Construction Manager to the date of termination;
- .2** Add the Construction Manager's Fee, computed upon the Cost of the Work to the date of termination at the rate stated in Section 6.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Section, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion;
- .3** Subtract the aggregate of previous payments made by the Owner; and
- .4** Subtract the costs and damages incurred, or to be incurred, by the Owner under Article 14 of AIA Document A201–2017.

§ 13.2.2.2 The Owner shall also pay the Construction Manager fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Construction Manager that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 13.2.2.1.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Construction Manager shall, as a condition of receiving the payments referred to in this Article 13, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Construction Manager, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Construction Manager under such subcontracts or purchase orders.

§ 13.2.3 Termination by the Owner for Convenience

If the Owner terminates the Contract for convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Construction Manager a termination fee as follows:

(Insert the amount of or method for determining the fee, if any, payable to the Construction Manager following a termination for the Owner's convenience.)

« »

§ 13.3 Suspension

The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017; in such case, the Guaranteed Maximum Price and Contract Time shall be increased as provided in Article 14 of AIA Document A201–2017, except that the term “profit” shall be understood to mean the Construction Manager's Fee as described in Sections 6.1 and 6.3.5 of this Agreement.

ARTICLE 14 MISCELLANEOUS PROVISIONS

§ 14.1 Terms in this Agreement shall have the same meaning as those in A201–2017. Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 14.2 Successors and Assigns

§ 14.2.1 The Owner and Construction Manager, respectively, bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 14.2.2 of this Agreement, and in Section 13.2.2 of A201–2017, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 14.2.2 The Owner may, without consent of the Construction Manager, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Construction Manager shall execute all consents reasonably required to facilitate the assignment.

§ 14.3 Insurance and Bonds

§ 14.3.1 Preconstruction Phase

The Construction Manager shall maintain the following insurance for the duration of the Preconstruction Services performed under this Agreement. If any of the requirements set forth below exceed the types and limits the Construction Manager normally maintains, the Owner shall reimburse the Construction Manager for any additional cost.

§ 14.3.1.1 Commercial General Liability with policy limits of not less than « » (\$ « ») for each occurrence and « » (\$ « ») in the aggregate for bodily injury and property damage.

§ 14.3.1.2 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Construction Manager with policy limits of not less than « » (\$ « ») per accident for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles, along with any other statutorily required automobile coverage.

§ 14.3.1.3 The Construction Manager may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided that such primary and excess or umbrella liability insurance policies result in the same or greater coverage as the coverages required under Sections 14.3.1.1 and 14.3.1.2, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 14.3.1.4 Workers' Compensation at statutory limits and Employers Liability with policy limits not less than « » (\$ « ») each accident, « » (\$ « ») each employee, and « » (\$ « ») policy limit.

§ 14.3.1.5 Professional Liability covering negligent acts, errors and omissions in the performance of professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 14.3.1.6 Other Insurance

(List below any other insurance coverage to be provided by the Construction Manager and any applicable limits.)

Coverage	Limits

§ 14.3.1.7 **Additional Insured Obligations.** To the fullest extent permitted by law, the Construction Manager shall cause the primary and excess or umbrella policies for Commercial General Liability and Automobile Liability to include the Owner as an additional insured for claims caused in whole or in part by the Construction Manager's negligent acts or omissions. The additional insured coverage shall be primary and non-contributory to any of the Owner's insurance policies and shall apply to both ongoing and completed operations.

§ 14.3.1.8 The Construction Manager shall provide certificates of insurance to the Owner that evidence compliance with the requirements in this Section 14.3.1.

§ 14.3.2 Construction Phase

After execution of the Guaranteed Maximum Price Amendment, the Owner and the Construction Manager shall purchase and maintain insurance as set forth in AIA Document A133™–2019, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price, Exhibit B, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 14.3.2.1 The Construction Manager shall provide bonds as set forth in AIA Document A133™–2019 Exhibit B, and elsewhere in the Contract Documents.

§ 14.4 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 14.5 Other provisions:

« »

ARTICLE 15 SCOPE OF THE AGREEMENT

§ 15.1 This Agreement represents the entire and integrated agreement between the Owner and the Construction Manager and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both Owner and Construction Manager.

§ 15.2 The following documents comprise the Agreement:

- .1 AIA Document A133™–2019, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price
- .2 AIA Document A133™–2019, Exhibit A, Guaranteed Maximum Price Amendment, if executed
- .3 AIA Document A133™–2019, Exhibit B, Insurance and Bonds
- .4 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .5 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

« »

- .6 Other Exhibits:
(Check all boxes that apply.)

[« »] AIA Document E234™–2019, Sustainable Projects Exhibit, Construction Manager as Constructor Edition, dated as indicated below:
(Insert the date of the E234-2019 incorporated into this Agreement.)

« »

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

- .7 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Construction Manager's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

This Agreement is entered into as of the day and year first written above.

OWNER *(Signature)*

« »« »

(Printed name and title)

CONSTRUCTION MANAGER *(Signature)*

« »« »

(Printed name and title)



DRAFT AIA® Document A133™ – 2019

Exhibit A

Guaranteed Maximum Price Amendment

This Amendment dated the « » day of « » in the year « », is incorporated into the accompanying AIA Document A133™–2019, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price dated the « » day of « » in the year « » (the “Agreement”)
(In words, indicate day, month, and year.)

for the following **PROJECT**:
(Name and address or location)

« »
« »

THE OWNER:
(Name, legal status, and address)

« »« »
« »

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

« »« »
« »

TABLE OF ARTICLES

- A.1 GUARANTEED MAXIMUM PRICE
- A.2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- A.3 INFORMATION UPON WHICH AMENDMENT IS BASED
- A.4 CONSTRUCTION MANAGER’S CONSULTANTS, CONTRACTORS, DESIGN PROFESSIONALS, AND SUPPLIERS

ARTICLE A.1 GUARANTEED MAXIMUM PRICE

§ A.1.1 Guaranteed Maximum Price

Pursuant to Section 3.2.6 of the Agreement, the Owner and Construction Manager hereby amend the Agreement to establish a Guaranteed Maximum Price. As agreed by the Owner and Construction Manager, the Guaranteed Maximum Price is an amount that the Contract Sum shall not exceed. The Contract Sum consists of the Construction Manager’s Fee plus the Cost of the Work, as that term is defined in Article 6 of the Agreement.

§ A.1.1.1 The Contract Sum is guaranteed by the Construction Manager not to exceed « » (\$ « »), subject to additions and deductions by Change Order as provided in the Contract Documents.

§ A.1.1.2 Itemized Statement of the Guaranteed Maximum Price. Provided below is an itemized statement of the Guaranteed Maximum Price organized by trade categories,

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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including allowances; the Construction Manager's contingency; alternates; the Construction Manager's Fee; and other items that comprise the Guaranteed Maximum Price as defined in Section 3.2.1 of the Agreement.
(Provide itemized statement below or reference an attachment.)

« »

§ A.1.1.3 The Construction Manager's Fee is set forth in Section 6.1.2 of the Agreement.

§ A.1.1.4 The method of adjustment of the Construction Manager's Fee for changes in the Work is set forth in Section 6.1.3 of the Agreement.

§ A.1.1.5 Alternates

§ A.1.1.5.1 Alternates, if any, included in the Guaranteed Maximum Price:

Item	Price

§ A.1.1.5.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Exhibit A. Upon acceptance, the Owner shall issue a Modification to the Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ A.1.1.6 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)

ARTICLE A.2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ A.2.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

☐ The date of execution of this Amendment.

☐ Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of execution of this Amendment.

§ A.2.2 Unless otherwise provided, the Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work. The Contract Time shall be measured from the date of commencement of the Work.

§ A.2.3 Substantial Completion

§ A.2.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Construction Manager shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

☐ Not later than « » (« ») calendar days from the date of commencement of the Work.

☐ By the following date: « »

§ A.2.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Construction Manager shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ A.2.3.3 If the Construction Manager fails to achieve Substantial Completion as provided in this Section A.2.3, liquidated damages, if any, shall be assessed as set forth in Section 6.1.6 of the Agreement.

ARTICLE A.3 INFORMATION UPON WHICH AMENDMENT IS BASED

§ A.3.1 The Guaranteed Maximum Price and Contract Time set forth in this Amendment are based on the Contract Documents and the following:

§ A.3.1.1 The following Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ A.3.1.2 The following Specifications:
(Either list the Specifications here, or refer to an exhibit attached to this Amendment.)

<< >>

Section	Title	Date	Pages

§ A.3.1.3 The following Drawings:
(Either list the Drawings here, or refer to an exhibit attached to this Amendment.)

<< >>

Number	Title	Date

§ A.3.1.4 The Sustainability Plan, if any:
(If the Owner identified a Sustainable Objective in the Owner's Criteria, identify the document or documents that comprise the Sustainability Plan by title, date and number of pages, and include other identifying information. The Sustainability Plan identifies and describes the Sustainable Objective; the targeted Sustainable Measures; implementation strategies selected to achieve the Sustainable Measures; the Owner's and Construction Manager's roles and responsibilities associated with achieving the Sustainable Measures; the specific details about design reviews, testing or metrics to verify achievement of each Sustainable Measure; and the Sustainability Documentation required for the Project, as those terms are defined in Exhibit C to the Agreement.)

Title	Date	Pages

Other identifying information:

§ A.3.1.5 Allowances, if any, included in the Guaranteed Maximum Price:
(Identify each allowance.)

Item	Price

§ A.3.1.6 Assumptions and clarifications, if any, upon which the Guaranteed Maximum Price is based:

(Identify each assumption and clarification.)

« »

§ A.3.1.7 The Guaranteed Maximum Price is based upon the following other documents and information:
(List any other documents or information here, or refer to an exhibit attached to this Amendment.)

« »

ARTICLE A.4 CONSTRUCTION MANAGER'S CONSULTANTS, CONTRACTORS, DESIGN PROFESSIONALS, AND SUPPLIERS

§ A.4.1 The Construction Manager shall retain the consultants, contractors, design professionals, and suppliers, identified below:

(List name, discipline, address, and other information.)

« »

This Amendment to the Agreement entered into as of the day and year first written above.

OWNER *(Signature)*

« »« »

(Printed name and title)

CONSTRUCTION MANAGER *(Signature)*

« »« »

(Printed name and title)

DRAFT AIA® Document A133™ – 2019

Exhibit B

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Construction Manager, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

« »
« »

THE OWNER:
(Name, legal status, and address)

« »
« »

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

« »
« »

TABLE OF ARTICLES

- B.1 GENERAL**
- B.2 OWNER'S INSURANCE**
- B.3 CONSTRUCTION MANAGER'S INSURANCE AND BONDS**
- B.4 SPECIAL TERMS AND CONDITIONS**

ARTICLE B.1 GENERAL

The Owner and Construction Manager shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE B.2 OWNER'S INSURANCE

§ B.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article B.2 and, upon the Construction Manager's request, provide a copy of the property insurance policy or policies required by Section B.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ B.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ B.2.3 Required Property Insurance

§ B.2.3.1 Unless this obligation is placed on the Construction Manager pursuant to Section B.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section B.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Construction Manager, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ B.2.3.1.1 **Causes of Loss.** The insurance required by this Section B.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

Cause of Loss	Sub-Limit

§ B.2.3.1.2 **Specific Required Coverages.** The insurance required by this Section B.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Construction Manager's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ B.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section B.2.3.1 or, if necessary, replace the insurance policy required under Section B.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ B.2.3.1.4 **Deductibles and Self-Insured Retentions.** If the insurance required by this Section B.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ B.2.3.2 **Occupancy or Use Prior to Substantial Completion.** The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section B.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Construction Manager shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ B.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section B.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ B.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- [☐] **§ B.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

☐ ☐

- [☐] **§ B.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

☐ ☐

- [☐] **§ B.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

☐ ☐

- [☐] **§ B.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

☐ ☐

- [☐] **§ B.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

☐ ☐

- [☐] **§ B.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

☐ ☐

- [☐] **§ B.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

☐ ☐

§ B.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[« »] § B.2.5.1 **Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

« »

[« »] § B.2.5.2 **Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

ARTICLE B.3 CONSTRUCTION MANAGER'S INSURANCE AND BONDS

§ B.3.1 General

§ B.3.1.1 **Certificates of Insurance.** The Construction Manager shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article B.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section B.3.2.1 and Section B.3.3.1. The certificates will show the Owner as an additional insured on the Construction Manager's Commercial General Liability and excess or umbrella liability policy or policies.

§ B.3.1.2 **Deductibles and Self-Insured Retentions.** The Construction Manager shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Construction Manager.

§ B.3.1.3 **Additional Insured Obligations.** To the fullest extent permitted by law, the Construction Manager shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Construction Manager's negligent acts or omissions during the Construction Manager's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Construction Manager's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ B.3.2 Construction Manager's Required Insurance Coverage

§ B.3.2.1 The Construction Manager shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Construction Manager shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below: *(If the Construction Manager is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)*

« »

§ B.3.2.2 Commercial General Liability

§ B.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than « » (\$ « ») each occurrence, « » (\$ « ») general aggregate, and « » (\$ « ») aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;

- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Construction Manager's indemnity obligations under Section 3.18 of the General Conditions.

§ B.3.2.2.2 The Construction Manager's Commercial General Liability policy under this Section B.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Construction Manager's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ B.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Construction Manager, with policy limits of not less than « » (\$ « ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ B.3.2.4 The Construction Manager may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section B.3.2.2 and B.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ B.3.2.5 Workers' Compensation at statutory limits.

§ B.3.2.6 Employers' Liability with policy limits not less than « » (\$ « ») each accident, « » (\$ « ») each employee, and « » (\$ « ») policy limit.

§ B.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ B.3.2.8 If the Construction Manager is required to furnish professional services as part of the Work, the Construction Manager shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ B.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Construction Manager shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ B.3.2.10 Coverage under Sections B.3.2.8 and B.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ B.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ B.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ B.3.3 Construction Manager's Other Insurance Coverage

§ B.3.3.1 Insurance selected and described in this Section B.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Construction Manager shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Construction Manager is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ B.3.3.2 The Construction Manager shall purchase and maintain the following types and limits of insurance in accordance with Section B.3.3.1.

(Select the types of insurance the Construction Manager is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

- [« »] § B.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section B.2.3, which, if selected in this Section B.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section B.2.3.1.3 and Section B.2.3.3. The Construction Manager shall comply with all obligations of the Owner under Section B.2.3 except to the extent provided below. The Construction Manager shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Construction Manager shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Construction Manager's obligation to provide property insurance differs from the Owner's obligations as described under Section B.2.3, indicate such differences in the space below.

Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

- [« »] § B.3.3.2.2 Railroad Protective Liability Insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for Work within fifty (50) feet of railroad property.

- [« »] § B.3.3.2.3 Asbestos Abatement Liability Insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

- [« »] § B.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

- [« »] § B.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the

Construction Manager and used on the Project, including scaffolding and other equipment.

[« »] **§ B.3.3.2.6 Other Insurance**

(List below any other insurance coverage to be provided by the Construction Manager and any applicable limits.)

Coverage

Limits

§ B.3.4 Performance Bond and Payment Bond

The Construction Manager shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type

Penal Sum (\$0.00)

Payment Bond

Performance Bond

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE B.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

« »

SECTION 00 72 00
GENERAL CONDITIONS

PART 1 GENERAL

1.01 FORM OF GENERAL CONDITIONS

- A. The General Conditions applicable to this contract is attached following this page.

1.02 RELATED REQUIREMENTS

- A. SECTION 00 73 00 - Supplementary Conditions.

1.03 SUPPLEMENTARY CONDITIONS

- A. Refer to Document 00 73 00 for amendments to these General Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 00 72 00



AIA[®] Document A201[™] – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503[™], Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining

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provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building

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information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the

site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's

capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes

remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the

time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed; and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under

Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the

Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate

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Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

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- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The

Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable

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by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The

foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers

to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not

constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the

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endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 **Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 **Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The

Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the

Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14. TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section

15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly

consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 72 00 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

- A. Section 00 60 00 - PROJECT FORMS.
- B. Section 00 72 00 - General Conditions.

1.03 MODIFICATIONS TO GENERAL CONDITIONS

- A. Refer to attached Document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 00 73 00

SUPPLEMENTARY CONDITIONS TO

AIA A133-2019

- § 1.2 Add the word “reasonably” before the word “rely” in the first sentence. Eliminate the phrase “in that event” and replace with “where warranted in the opinion of Owner.”
- § 3.1.1 Add the words “have a duty to” after the words “but the Construction Manager shall”.
- § 3.1.2 Add the following after the word “other”:
“all in conformity with La. R.S. 38:2225.2.4.”
- § 3.1.3.1 Add the word “regularly” after the word “shall.”
- § 3.1.5 Add after “recommendations” in the first sentence the following:
“to the Owner and Architect”
- 3.1.6.2 Add “an opinion of probable cost of the project when final design of the project is not more than sixty percent complete, and again when final design of the project is not more than ninety percent complete” after “the Construction Manager shall prepare”
- § 3.1.12 Replace with the following:

The Construction Manager shall prepare, for the Architect’s review and the Owner’s Acceptance, a procurement schedule for items that must be ordered well in advance of construction. The Construction Manager shall expedite and coordinate the ordering and delivery of materials that must be ordered well in advance of construction.
- § 3.2.2 Delete the final sentence.
- § 3.2.3.3 After the word “Price”, insert the following:

In the form of a schedule of values as described in § 11.1.5.
- § 3.2.3.4 Replace the existing § 3.2.3.4 with the following:

The Date of Substantial Completion upon which the proposed Guaranteed Maximum Price is based, and a schedule of the Construction Documents issuance dates upon which the date of Substantial Completion is based.

§ 3.2.3.5 Delete it its entirety.

§ 3.3.2.1 Replace the existing § 3.3.2.1 with the following:

The Construction Manager shall schedule and conduct no less than bi-weekly meetings at which the Owner, Architect, Construction Manager and appropriate Subcontractors can discuss the status of the Work. The Construction Manager shall prepare and promptly distribute detailed meeting minutes. If weekly meetings are required, there shall be no additional cost.

§ 4.1.2 Delete in its entirety.

§4.1.3 Delete in its entirety.

§ 4.2.1 Delete in its entirety.

§ 5.1.3 Delete in its entirety.

§ 5.2.1 Replace the existing § 5.2.1 with the following:

Payments shall be made in a timely manner following presentation of the Construction Manager's invoice and, where applicable, shall be in proportion to services performed.

§ 5.2.2 Delete in its entirety.

§ 7.5.2 Replace the entire section with the following:

Rental charges for temporary services and facilities, machinery, equipment and hand tools not customarily owned by the construction workers, which are provided by the Construction Manager at the site, and costs of transportation, installation, minor repairs and replacements, dismantling and removal thereof. All such rental charges shall be included in the Cost of the Work at 100% of the rates set forth in the latest edition of the Rental Rate Blue Book for Construction Equipment published by Primedia Information, Inc. (or similar publication upon approval by the Owner) unless equipment is rented from third parties specifically for the Project, in which case rental charges for that equipment shall be included in the Cost of the Work at the actual cost of the Construction Manager. Should the total rental cost of any such equipment exceed the purchase price of same, Construction Manager agrees to immediately notify Owner to determine whether the equipment should be leased or purchased. If the equipment is to be purchased, then Construction Manger and Owner shall confer as to the method and timing of procurement.

§ 7.6.5.1 Delete in its entirety.

§ 7.6.9 Delete in its entirety.

§ 7.7.3 Delete in its entirety.

§ 7.7.4 Delete in its entirety.

§ 7.9.1.2 Add the words “in writing” after “prior approval.”

§ 9.1 Eliminate everything after the first sentence.

§ 9.1.1 Eliminate in its entirety.

§ 10 Replace the entire section with the following:

The Construction Manager shall keep full and detailed records and accounts related to the cost of the Work, and exercise such controls as may be necessary for proper financial management under this Contract and to substantiate all costs incurred. The accounting and control systems shall be consistent with and/or similar to those systems being accepted in the industry for maintaining the records required to be maintained by the Construction Manager under this agreement. The Owner and the Owner’s auditors shall, during regular business hours and upon reasonable notice, be afforded access to, and shall be permitted to audit and copy, the Construction Manager’s records and accounts, including, but not limited complete documentation supporting accounting entries, books, correspondence, instructions, drawings, receipts, subcontracts, Subcontractor’s proposals, purchase orders, vouchers, memoranda and all other data relating to this Contract. The Construction Manager shall preserve these records for a period of three years after final payment, or for such longer period as may be required by law.

§ 11.1.6 Replace with the following:

Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage completion shall be the percentage of that portion of the Work which has actually been completed.

§ 11.1.9 Delete in its entirety.

§ 11.1.11 Delete the entire section.

§ 11.2.2 Replace with the following:

The Owner may audit and make written comments on the Construction Manager’s final accounting. The audit and comments should be completed within thirty (30) days after delivery of the final accounting by the Architect to the Owner. Within

seven days after receipt of the written comments of the Owner or notice that the Owner will not be submitting comments, the Architect will substantiate the Construction Manager's final accounting and verify that the conditions in § 11.2.1 have been met, and either issue to the Owner a final Certificate of Payment with a copy to the Construction Manager, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding a certificate as provided in Section 9.5.1 of the AIA Document A201-2017. The time periods states in this Section supersede those stated in Section 9.4.1 of the AIA Document A201-2017.

§ 11.2.3 Add the following:

Any disputes concerning the final payment will be resolved as provided in A201-2017, Article 15.

§ 11.2.4 Add new section as follows:

Owner shall not make any payment to any person or entity that is inconsistent with its obligations under the Louisiana Public Works Act, and shall have no obligation to make any final payment until all statements of claim and privilege and/or liens have been resolved to Owner's satisfaction. This provision shall control over any provision in the contract to the contrary.

Article 12 Replace the entire Article with the following;

Any Claim between the Owner and Construction Manager shall be resolved in accordance with the provisions set forth in Article 15 of the A201-2017, as amended by the supplementary conditions thereto.

§ 13.1.5 Delete.

§ 13.2 Replace entirety of 13.2 (including subsections) with the following:

Following execution of the Guaranteed Maximum Price Amendment, the Contract may be terminated as provided in Article 14 of AIA Document A201-2017, as amended by the supplementary conditions thereto.

END OF DOCUMENT

SECTION 008000 SUPPLEMENTARY CONDITIONS

The following supplements modify the "General Conditions of the Contract for Construction, AIA Document A201 2017 Edition -Electronic Format". Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1: GENERAL PROVISIONS

1.2 Correlation and Intent of the Contract Documents

Add the following Subparagraph 1.2.4:

1.2.4 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to and govern the execution of the work of all Sections of the Specifications.

ARTICLE 3: CONTRACTOR

3.6 Taxes

Remove the entirety of the paragraph and add the following:

Audubon Commission is Sales Tax Exempt. The Contractor shall be sales tax exempt when making purchases on behalf of the owner for this project. Documentation will be provided to the contractor for this purpose. Sales tax shall not be included when submitting bid cost.

3.7 Permits, Fees, Notices, and Compliance with Laws

3.7.1 Modify the paragraph as follows:

Change "Contractor" to "Owner". The paragraph shall read "Unless otherwise provided in the Contract Documents, the owner shall pay for the building permit. It will be the responsibility of the contractor to apply for and secure all permits.

ARTICLE 5: SUBCONTRACTORS

5.2.3 Remove in its entirety

ARTICLE 7: CHANGES IN THE WORK

7.2.1 Change Orders

Add the following subparagraph 7.2.1.4

Change Orders are allowed for execution in electronic format and are required to be paid within 60 days of approval of application for payment.

Add the following subparagraph 7.2.2:

“Cost of the Work” for the purpose of Change Orders shall be costs actually required to be incurred in performance of the work and paid by the Contractor and Subcontractors. Such costs shall consist only of the following:

- .1 Wages paid for direct labor personnel, delineating a labor burden markup for applicable payroll taxes, worker’s compensation insurance, unemployment compensation, and social security taxes.
- .2 Costs of direct materials and supplies, including the identification of each item and its cost.
- .3 Costs of necessary machinery and equipment required by the Change Order, including the identification of each and the allocation of its cost, and the bases therefore, to the change in the Work
- .4 Other direct costs, properly documented.
- .5 Costs of premiums for bonds and insurance directly related to the change in work.

ARTICLE 9; PAYMENTS AND COMPLETION

9.8 Substantial Completion

Delete 9.8.5 in its entirety and substitute the following:

9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

9.10 Final Completion and Final Payment

Add the following Subparagraph to 9.10.2:

- .1 Retainage will not be released until a clear Lien Certificate is recorded.

ARTICLE 10; PROTECTION OF PERSONS AND PROPERTY

10.1 Add to the sentence.

- a. And shall be required to comply with 29 CFR 1926 OSHA Construction Regulations

ARTICLE 11; INSURANCE AND BONDS

Add the following requirements to apply to all insurance and bonds required under ARTICLE 11.

- a. Insurance and bonds provided by the Contractor shall be with a reliable company (having at least an "A VIII": rating according to the latest A.M. Best Key Rating Guide and on the

U.S. Treasury List) of the Contractor's choice, acceptable to and approved by the Owner and authorized to do business in the state where the project is located or by an insurance company in good standing licensed to write bonds which is either domiciled in Louisiana or owned by Louisiana residents or a surety or insurance company currently on the U.S. Department of Treasury Financial Management Service list of approved bonding companies which is published annually in the Federal Register.

- b. The Contractor shall have the policies endorsed to permit occupancy of all or part of the work by Owner at any time during the coverage term of the policies.
- c. All liability policies referred to in this Article shall be maintained in the same company.
- d. All insurance furnished in compliance with this Article shall include the Owner, his agents, consultants, employees and representatives and the Architect as additional named insured and shall waive rights of subrogation against the Owner. The Owner so stated on all insurance Certificates shall be as indicated on the Contract.
- e. Contractor shall furnish a Certificate of Insurance indicating that the Indemnification clause included in 3.18 has been added to his Comprehensive General Liability Policy with the same limits of coverage indicated herein.
- f. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Contractor.

11.1 Insurance and Bonds

Add the following Subparagraph 11.1.1.1

11.1.1.1 All contractors who are to perform work at an Audubon property shall be required to carry the following insurance coverage. This includes but is not limited to construction contractors and any others who are performing services on Audubon property.

Audubon Commission & Audubon Nature Institute on a primary and non-contributory basis for general liability shall be listed as an additional insured (to the extent Contractor/Audubon Commission/Audubon Nature Institute/City of New Orleans are indemnified pursuant to the indemnity provisions herein) on all certificates of insurance for all public works contracts, for all other work.

A Waiver of Subrogation shall be provided in favor of Audubon Commission/Audubon Nature Institute/City of New Orleans for General Liability and Automobile Liability.

Audubon Commission/Audubon Nature Institute/City of New Orleans shall be listed as a certificate holder. Audubon Commission/Audubon Nature Institute shall be notified of any termination, of these stated insurance requirements within 30 days and 10 days for non-payment of premium. Certification must include; name and address of insurance company (must be authorized by an Insurance Department in Louisiana to transact business in the State of Louisiana); policy number, and liability coverage, limits, deductible (if applicable) along with special endorsements requested (ie: Additional Insured on a Primary & Non-Contributor basis, Waiver of Subrogation and Cancellation Clause).

Insurance certificates shall be provided to Purchasing prior to the start of any work. At the below address:

Audubon Commission/Audubon Nature Institute/City of New Orleans

Attn: Senior Purchasing Director

Magazine Street

New Orleans, LA 70118

There is an "Artist" exception to this policy. Artistic projects that require substantial construction or the use of heavy equipment, artistic services should fall under a general contractor who will carry the required insurance. Artistic Services such as painting or where the artwork is being created off-property, Audubon will review the need for insurance, on a case-by-case basis.

Worker's Compensation - Statutory

- a. Audubon is not required to be listed as additionally insured.
- b. Employer's Liability:
 - i. Each Accident: \$1,000,000
 - ii. Disease: 1,000,000
 - iii. Policy Limit, Each Employee: 1,000,000

Automobile Liability

- a. Each Person: \$1,000,000
- b. Each Accident: 1,000,000

General Liability (including Premises Operations; Independent Contractors' Protective, Products and Completed Operations, Broad Form Property Damage, Contractual Liability (Hold Harmless Coverage)

- c. Bodily Injury: \$1,000,000;
 - i. Each Occurrence: \$1,000,000
 - ii. Aggregate: \$2,000,000
- d. Property Damage: 1,000,000
 - i. Each Occurrence: \$1,000,000
 - ii. Aggregate: \$2,000,000

Professional Liability if applicable): \$2,000,000 minimal but no less than project value. If General Liability policy includes a General Aggregate, such General Aggregate shall not be less than \$2,000,000.

Excess/Umbrella Liability: limits of no less than \$5,000,000.

11.1 CONTRACTOR'S INSURANCE AND BONDS

Delete 11.1.2 in its entirety and substitute the following:

11.1.2 The Contractor shall furnish and pay for a Performance Bond and Labor and Material Payment Bond of a company on the U.S. Treasury List, complying with Louisiana Revised Statutes 9:4801 and qualified to do business in the State in which the project is being constructed, and which is acceptable to and in form approved by the Owner, each bond in an amount equal to one hundred percent (100%) of the Contract Sum, as security for the true and faithful performance of the Contract and payment in full of all subcontractors and persons performing labor, services, materials, machinery and fixtures in connection with the work. The surety shall be bound *in solido* with the Contractor. The executed bonds, together with the bonding agent's power of attorney, shall be furnished to the Owner along with the executed Contract, and the number of copies reasonable required by him.

11.1.2.1 The Contractor shall deliver the required bonds to the Owner not later than the date the Agreement is entered into; or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence

satisfactory to the Owner that such bonds will be furnished.

11.1.2.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 12; UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

Add the following to 12.2:

12.2.6 The corrective remedies set forth in this Paragraph 12.2 are not exclusive and shall not deprive the Owner of any action right or remedy otherwise available to it for breach of any of the provisions of the Contract Documents and for any damages suffered by Owner as a result of such defects in the Work.

ARTICLE 14; TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 Replace the number “30” with “90.”

14.1.2 Delete

14.1.3 Delete the phrase “as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.”

14.1.4 Replace the number “60” with “90.”

14.2 TERMINATION BY THE OWNER FOR CAUSE

Delete the word “repeatedly” in section 14.2.1.3.

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

Delete paragraph 14.3.2.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

In subparagraph 14.4.3, delete everything after the word “executed.”

ARTICLE 15; CLAIMS AND DISPUTES

Replace 15.1.6.1 and 15.1.6.2 with below.

15.1.6 CLAIMS FOR ADDITIONAL TIME

15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor’s Claim shall include an estimate of cost

and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. A Claim for an increase in the Contract Time will only be considered for critical path activities, as identified on the approved baseline schedule required by Section .3.10.1

15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction. An increase in the Contract Time due to weather shall not be cause for an increase in the Contract Sum.

Add 15.1.6.3 through 15.1.6.5.4

15.1.6.3 The Contract Time already considers the following reasonably anticipated days of adverse weather, on a monthly basis. These days are presented below on monthly basis for informational purposes only. Said monthly presentation does not give the Contractor the right to assert Claims for additional time due to weather delays on a monthly basis.

January	11 days	May	5 days	September	4 days
February	10 days	June	6 days	October	3 days
March	8 days	July	6 days	November	5 days
April	7 days	August	5 days	December	8 days

15.1.6.4 The Contractor shall report to the Owner total adverse weather days incurred each month.

15.1.6.5 The time stipulated for Substantial Completion of the Work includes the anticipated delays due to normal adverse weather conditions for the months encompassed in the Project duration which are stated in Section 15.1.5.3 above. The Contractor shall not be allowed to make a Claim for additional Time due to weather delays until and unless such weather delays exceed the TOTAL reasonably anticipated adverse weather delays, for the entire contract duration, stated in Section 15.1.5.3 above. Contractor's request will be considered only for the days over the reasonably anticipated days of adverse weather stated above. In order to make a Claim for additional Time due to adverse weather, the Contractor shall:

15.1.6.5.1 Document, in writing, that the cumulative total of actual adverse weather delays exceeds the TOTAL reasonably anticipated adverse weather delays stated in Section 15.1.5.3 above.

15.1.6.5.2 Document, in writing, that the weather on each particular day of claimed adverse weather was of such nature (rain, wind, snow, ice, and subsequent resultant effects) that it

significantly impacted Contractor's ability to make progress on critical path work items. Adverse weather delay days will not be granted for weekends or holidays unless Contractor can demonstrate that it had been and intended to work on these days.

15.1.6.5.3 Not submit the Contractor's first claim for additional Time due to adverse weather until after the cumulative total of actual adverse weather days exceed the allowable days as stated in Section 15.1.5.3 above. That claim must be submitted within 7 days of the end of the month in which that cumulative total is first exceeded. Thereafter, Contractor shall submit any Claims for additional time due to adverse weather on a monthly basis, within 7 days of the end of the month.

15.1.6.5.4 Summarize the number of adverse weather delay days claimed for the entire month with each month's Application for Payment.

15.4 ARBITRATION

Delete the entirety of section 15.4 Re-title section 15.4 as "Venue and Choice of Law" and insert the following:

15.4.1 This Agreement shall be governed by the law of the State of Louisiana. Any and all litigation arising out of, or relating to, this Agreement shall be filed in the Civil District Court for the Parish of Orleans, State of Louisiana.

END OF DOCUMENT

State of Louisiana
Department of Revenue and Taxation
Certificate Covering Sales/Use Tax Exemption/Exclusion
Covering Purchases by Political Subdivisions of
the State of Louisiana
Louisiana R.S. 47:301(8) (c)

<u>Political Subdivision</u> Audubon Commission (Public Agency)
<u>Address</u> 6500 Magazine Street
<u>City</u> New Orleans, Louisiana, 70118

The above referenced entity does hereby certify that the entity is a public agency of the State of Louisiana created by Act 191 of 1914.

Purchases of tangible personal property and taxable services, and/or leases and rentals of tangible personal property by the above referenced political subdivision are totally exempt from sales tax levied by the state as provided by Louisiana Revised Statute 47:301(8)(c). The Louisiana Constitution, Article VI, S 44(2) defines a political subdivision as "a parish, municipality, and any unit of local government, including a school board and a special district, authorized by law to perform government functions".

The Audubon Commission is also exempt from the payment of the local sales and use tax since it is created by a State Act.

Audubon Commission Facilities:

- Audubon Park
- Audubon Zoo
- Woldenberg Park
- Audubon Aquarium of the Americas
- Audubon Center for Research of Endangered Species
- Audubon Louisiana Nature Center
- Audubon Insectarium
- Insect Rearing Facility
- Aquatic Center

The authorized person for the political subdivision certifies that the entity meets the criteria for the sales tax exclusion under R.S. 47:301 (8) (c), and if sales tax is later found to be due, the entity will be responsible for any tax liabilities.

Signature of Authorized Agent

<u>Authorized Agent</u> CAROLINE TIERNEY	<u>Title</u> V.P. of FINANCE
<u>Signature</u> Carolene Tierney	<u>Date (mm/dd/yyyy)</u> 01/12/2023

SECTION 01 1000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Owner-furnished/Contractor-installed (OFI) products.
 - 4. Contractor's use of site and premises.
 - 5. Coordination with occupants.
 - 6. Work restrictions.
 - 7. Specification and Drawing conventions.
- B. Related Requirements:
 - 1. Section 01 1500 Activity Limitations.
 - 2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

- A. Project Identification: Odenheimer Building
 - 1. Project Location: New Orleans, LA.
- B. Owner: Audubon Nature Institute in Conjunction with Audubon Commission
- C. Architect: Eskew+Dumez+Ripple, APC.
- D. Construction Manager: .
 - 1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
- E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 01 3100 "Project Management and Coordination." for requirements for establishing administering and using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the construction of a zoo visitor's center as documented on the drawings.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract based on a Stipulated Price as described in Document 00 6000 - PROJECT FORMS.

1.5 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFICI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 - 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 - 2. Provide for delivery of Owner-furnished products to Project site.
 - 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 - 4. Obtain manufacturer's inspections, service, and warranties.
 - 5. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
 - 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
 - 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
 - 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
 - 4. Make building services connections for Owner-furnished products.
 - 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 - 6. Repair or replace Owner-furnished products damaged following receipt.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
 - 1. Work by Others.
 - 2. Work by Owner.
 - 3. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

1.7 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.
 1. Weekend Hours: By request only.
 2. Early Morning Hours: Prior to 8:00am by request only.
 3. Hours for Utility Shutdowns: By request only.
 4. Hours for Core Drilling and generally noisy activity: 8:00 a.m. to 5:00 p.m.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. **Nonsmoking Building:** Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 1500

ACTIVITY LIMITATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes provisions for construction operations on the Owner's property performed by the Contractor or any party providing goods or services as a part of this contract. Project including, but not limited to, the following:
 - 1. Construction Coordination.
 - 2. Public and Zoo Staff Access.
 - 3. Contractor's use of the Owner's property.
 - 4. Construction Limits.
 - 5. Penalties.
- B. Related Sections include the following:
 - 1. Division 1 Section "Construction Progress Documentation" for Preparing and submitting Contractor's Construction Schedule.
 - 2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field -engineering services, including establishment of benchmarks and control points.

1.3 COORDINATION

- A. General: Promptly upon award of the contract, notify all pertinent personnel regarding requirements of this Section.
- B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for activities. Include such items as required notices and reports.
- D. Construction Limits and Staging Areas: To as great an extent as possible, the Contractor has been assigned permanent construction limits, storage and staging areas, and access routes.
- E. Public and Zoo Staff Access: Maintain continuous and unobstructed access by the public and the zoo staff to all areas not within the area of the Work of this Contract. Temporary interruptions to this access or to the utility services to the Buildings within this area are at the discretion of the Owner. Make written request to the Owner 72 hours prior to any proposed interruption of access or utility service.

1.4 CONTRACTOR'S ACCESS TO ZOO

- A. Deliveries: To avoid traffic conflict with Local Residents, and to avoid overloading of streets and driveways elsewhere on the Owner's property, limit the access of trucks, deliveries of materials and tools, workmen, and all other equipment to a route agreed to by both the General Contractor and by the Owner.
 - 1. No delivery of materials for the work of this Contract will be accepted at facility gates or offices other than that established by the prior approval of the owner. Contractor to coordinate designated delivery access with Owner prior to any deliveries.

1.5 CONTRACTOR'S ACCESS TO THE CONSTRUCTION SITE

- A. General: Require Contractor's vehicles, vehicles belonging to employees of the Contractor, and all other vehicles and workmen entering upon the Owner's property in performance of the work of the Contract, to use only the Access Route described in this section and as indicated on the drawings.
 - 1. Restore the construction Access Route as indicated on the drawings following completion of the Work.
 - 2. Secure all Street Use or other permits required for this Access Route.
 - 3. Provide the specified construction fencing along all edges of the construction access route if one is not already present. If using an existing fence, the fence must be restored to its original condition.
 - 4. There is no access to be granted outside of Construction areas at any time during construction.

1.6 STAGING, PARKING, AND STORAGE AREAS

- A. General: Staging and storage areas are shown on the Drawings. No other staging and storage areas are available on the grounds of the Zoo.
 - 1. The Contractor will provide all required arrangements for offsite storage and staging of materials.
 - 2. The Contractor designated parking and site access must be reviewed and approved by the Owner.
 - 3. Upon completion of the project, the staging and surrounding area are to be cleaned of all materials and trash.

1.7 SECURITY AND SAFETY

- A. General: Restrict the access of all persons entering upon the Owners' property in connection with the Work to the limit of work lines shown on the plans.
 - 1. Normal Hours of Work are between 7:00 a.m. - 5:00 p.m, Monday through Friday.
 - 2. Notify Owner's security of any work to be performed outside the normal hours of work; Owner approval and pre-scheduling is required.
 - 3. Emptying of dumpsters and other noisy activities shall not occur during Owner's facility operating hours.
 - 4. The Contractor is responsible for maintaining public safety in and around the construction site. Provide temporary fencing or other methods as the Contractor deems appropriate.
 - 5. There is no access to be granted outside of construction areas at any time during construction.
 - 6. The General Contractor's Superintendent shall be on site at any and all times Work is in progress.
 - 7. The Contractor and all associated subcontractors will follow the rules outlined in the 2023 Audubon Contractor Handbook following this section.
- B. Locking Gates: All gates must be closed and locked at all times except during actual passage of workmen, supplies, or equipment.

1. Coordinate keying and key control procedures with the Owner.
 2. If a gate is required to be open for an extended period of time, the Contractor will notify the Audubon Project Manager and include manned oversight.
- C. Safety:
1. The speed limit on Zoo grounds is 5 miles per hour.
 2. Secure or chain ladders and other equipment when not in use and after working hours to prevent use by vandals.
- D. Animal Safety: No Contractor shall have access to any animal areas or enclosures except in the presence of an Animal Keeper or Curator.
1. Allow no one to bring pets or animals of any kind to the Zoo grounds, whether in vehicles or not.
 2. Allow no one to bring radios and/or other audio devices onto the Zoo grounds.
 3. The timing of the use of power activated drivers must be coordinated and approved by ANI staff. Discharge sounds like a gun shot can cause animals to charge fencing and injure themselves.
 4. Any work anticipated to cause loud noises should be discussed with the Audubon Project Manager and animal staff 72 hours in advance to reduce possible animal impact.

1.8 EXISTING TREE AND SHRUB PROTECTION

- A. General: Carefully protect all existing shrubs and trees designated to remain during the course of the Work of this Contract.
1. Comply with all requirements of section 01 56 39: Landscape Protection During Construction.

1.9 KEEPING ROADS AND STREETS CLEAN

- A. Vehicle Wash Down: Establish a wash down area (stone construction exit) as indicated on the drawings. All vehicles leaving the site are to use this facility to prevent soil or other debris from being distributed on the roads/streets outside of the project site. The wash down area must be cleaned/refurbished as required to maintain its effectiveness at providing a soil free surface for complete vehicle wash off.
- B. Debris left on roads and streets outside the project area must be cleaned by the Contractor immediately upon discovery.
- C. Concrete washout pit: located next to the wash down area, all washout of concrete trucks and equipment must occur in this location.

1.10 PENALTIES

- A. General: Contractor shall be aware that the Owner will assess a fine of \$1000.00 (One Thousand Dollars) plus the cost to repair any damages resulting from the violation. This penalty will be assessed for each and every violation of the following list of required items. Charges will be assessed on a per occurrence, per day basis.
1. Starting work without specified construction fence.
 2. Storage of materials outside of the staging area or limit of work line.
 3. Parking outside of the designated areas.
 4. Leaving the access gate open and unattended.
 5. Access fence or gate not dog tight (does not apply to Owner supplied gate).
 6. Exceeding speed limit within Zoo grounds.
 7. Contractor found in animal area without ANI personnel escort.
 8. Concrete truck or equipment washout outside of designated area.

9. Soil or debris distributed on roads/streets outside of the project site.
10. Failure to completely clean up the staging and surrounding area within thirty (30) days after substantial completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

Reference contractor handbook attached.

END OF SECTION



Audubon Nature Institute
Celebrating the Wonders of Nature

Audubon Zoo and Park

Contractor/Vendor Handbook and Audubon Zoo Emergency Action Plan

June 6, 2023

ACKNOWLEDGEMENT

Receipt of Contractor Handbook and Emergency Action Plan

I acknowledge having received a copy of Audubon Zoo & Park Contractor/Vendor Handbook and Emergency Action Plan.

I understand I am responsible for compliance with these regulations, policies, and procedures. I understand it is my responsibility to read the Handbook carefully and ensure that any subcontractors are also familiar with the information contained herein. I am also aware that I may inquire about the policies and procedures of the Institute at any time. My signature below confirms that I understand and agree to follow and be bound by all said policies and procedures.

I understand that Audubon Nature Institute reserves the right to modify, revoke, or supplement the manual at any time with or without notice.

Company Name

Contractor's Printed Full Name

Contractor's Signature and Date

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Audubon Zoo Emergency Action Plan

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I. Introduction

The purpose of Audubon Nature Institute is to celebrate the wonders of nature by creating a family of museums and parks dedicated to the natural environment. To date, the Audubon family consists of: Audubon Park, Audubon Zoo, Audubon Aquarium of the Americas, Audubon Insectarium, Woldenberg Riverfront Park, Audubon Louisiana Nature Center, Freeport-McMoRan Audubon Species Survival Center and Audubon Center for Research of Endangered Species, Audubon Wilderness Park, and Audubon Institute Foundation.

To achieve its goals, Audubon Nature Institute employs many individuals in many different fields with many skills and experiences. Each job is important to the overall success of the operation of Audubon Nature Institute. The way each contractor performs their job directly determines the degree of excellence achieved by the whole organization.

II. Our Core Values

Service We recognize the importance of each and every guest's experience and strive to make each one memorable through genuine hospitality, an attitude of caring, and careful training to ensure exceptional customer service.

People We value the great potential of each individual within the Audubon family. We stimulate initiative and maximize talent through clearly stated goals, professional training, and the job support necessary to ensure individual success that exceeds expectations.

Stewardship We adhere to the highest standards in assuring the well-being of the animals and their habitats under our care and through pace-setting research, conservation, and education programs, we work to preserve nature on the local, regional, national, and global scale.

Innovation We enhance and encourage creativity, aggressively seeking to set new standards in all that we do, from new exhibit development to animal breeding programs.

Diversity We believe in recruiting from a diverse talent pool to build and maintain an extraordinary workforce. Our hiring and promotion practices emphasize ability, and potential, eliminating barriers based on race, age, gender, sexual orientation, physical limitations, religion, ethnic background, or national origin.

Cooperation Our growth and development--our every accomplishment--is made possible through a spirit of teamwork that unites our staff, galvanizes our community, and ensures attainment of our mission, from educating our diverse audience to enhancing the care and survival of wildlife.

Leadership We seek to be industry role models and civic leaders, always guided by the highest professional and ethical standards, as well as an entrepreneurial spirit that recognizes selective economic development as a vehicle for advancing environmental education.

Stability Maintaining economic stability through financial self-sufficiency is paramount as we fuel our operations and strive to fulfill our ambitious vision for the future.

Fun Our celebrations of life emphasize enjoyment of the world around us. Good humor, optimism, and playfulness translate into a healthy workplace, and the ideal environment for teaching others about the wonders of life and nature.

III. Our Service Standards

- Smile and be friendly.
- Be an ambassador; always talk positively.
- Own each guest experience. If you receive a request or complaint, follow it through.
- Dress appropriately and wear your name tag.
- Smile, you can hear it over the phone; use proper telephone etiquette.
- Know and perform procedures in emergency situations.
- Make it safe! Observe safety requirements, consider yourself and others.

- Practice proper maintenance and repair of property and equipment.
- Know our stuff- be aware of Audubon information to answer guest inquiries.
- Pick it up! The cleanliness of our facilities is the responsibility of every employee and contractor on site.
- Contribute to a positive work environment; practice teamwork and service to each other.
- Practice resource conservation.

IV. Harassment Free Workplace

Audubon Nature Institute is committed to a policy of providing a working environment free from harassment in any form: verbal, physical, sexual, or visual. This type of misconduct will not be tolerated by anyone working on Audubon property. A violation could result in the individual employee being banned from Audubon properties.

V. Drug Free Workplace

Audubon Nature Institute is committed to providing a workplace free from drug and alcohol abuse. The use, possession, concealment, transportation, promotion, purchase, and/or sale by individuals of the following items or substances is prohibited on all Audubon Nature Institute property:

- All illegal drugs and other illegal substances
- Any non-prescription drug, substance or other item as defined or listed by state or federal law as a “controlled substance”
- Synthetic drugs, “designer drugs” or “look-alike drugs”
- Alcoholic beverages
- Drug paraphernalia
- Prescription drugs which are unauthorized

VI. Background Investigations & Drug Screening

Audubon is committed to providing safe facilities for our employees and guests. Audubon reserves the right to, at any time, require individuals working on behalf of vendors/contractors who are at Audubon Facilities regularly and/or have unsupervised access to Audubon guests, particularly children, to pass background investigations and/or drug screening.

VII. Firearms

Firearms are not allowed on Audubon Nature Institute property. The only exceptions are members of the Audubon Weapons Team, hired details such as New Orleans police officers or other armed security details.

VIII. Smoking/Vaping Policy

Purpose

To establish Audubon Zoo’s policy and guidelines regarding smoking/vaping privileges for employees, guests, vendors, contractors, volunteers, and interns, as we strive to maintain a safe, healthy, and professional work environment. This policy was developed based on several considerations including human and animal health, fire and safety hazards, and the Zoo’s public image.

Policy

Smoking is NOT permitted in any public area of the Zoo.

Contractors are permitted to smoke only in the following, non-public, areas. These areas are designated with “smoking permitted” signage and cigarette receptacles.

- Backroad near Gate 2 along fence line
- Inside Gate 4.5 near dumpsters
- Outside gates near Catering Building

Note: Service gates must always be closed.

IX. Facility Cleanliness

All contractors and vendors should keep their work area and equipment clean and neat. All individuals are responsible for the appearance of our facilities; therefore, we ask that everyone please pick up any litter seen on the grounds and deposit it in the appropriate receptacle. In the event of large spills, contact Facility Services for clean-up.

X. Parking

Contractor parking is available in the public lot nearest the Administration entry (Gate 1) in Rows 1 – 6. Contractor parking is not permitted inside Zoo grounds without prior approval. Contractors who have been permitted access may park along the backroad near the compactor in the designated location. There will be an exception to this policy, if the contractor needs close access to a specific building such as Administration, they will be permitted to park inside the gates in visitor parking, if the work needing to be performed requires quick access to tools and work truck.

XI. Vehicle Operation

There are several types of vehicles used throughout Audubon Nature Institute facilities. Operators must possess a valid State driver’s license. Cars, trucks, golf carts and other vehicles may only be used by those with permission from an authorized Audubon employee.

- Vehicles must be driven in a slow and safe manner. Pedestrians always have the right-of-way.
- Vehicles driven on city streets must observe all municipal regulations including parking (no parking on sidewalks).
- Contractors will need to be escorted to the area the contractor will be working in either by Security or another person overseeing their work.
- Use of Audubon’s heavy equipment may be authorized, but only after the contractor has demonstrated their employees have the proper certification.
- No contractor shall be permitted to access the public space using a vehicle during operational hours without an escort.

XII. Dumpster Use

Contractors will provide their own dumpster. Use of Audubon dumpsters is prohibited without prior approval from either C&E or Facilities

XIII. Lost and Found

All items found in public areas should be turned over to Guest Services as soon as possible with details concerning when, where, and by whom the item was found.

XIV. Safety

Safety is important in the performance of your job. Observance of the rules outlined in this policy is essential to safety. In addition, contractors shall avoid areas off limits for their safety or that of our animals. Contractors should familiarize themselves with emergency procedures in case of

fire, animal escapes, civil disturbances, etc. Review the Emergency Action Plan included here for details about specific emergency situations. Contractors and their subcontractors must follow all OSHA Requirements for General Industry or Construction depending on what work is being provided.

Remember, the best approach to safety on the job is to prevent accidents from occurring in the first place.

- Report unsafe conditions to your supervisor immediately.
- Immediately pick up anything you have dropped or any foreign objects on the floor.
- Wipe up any spill immediately.
- When walking on wet or slippery floors, do so slowly.
- Do not attempt to operate any piece of equipment unless specifically trained to do so.
- Report every accident or injury no matter how slight to your supervisor and Audubon First Responder if immediate medical attention is required.
- Any unsafe acts should be reported to Zoo Safety for further follow-up and corrective action.

XV. Guest Safety

Contractors should be mindful of potentially dangerous acts by guests, such as placing children on rails or limbing in exhibits. If guests are seen engaging in these or other acts which could threaten the safety of the visitor or the animals, please contact Audubon Security via phone or radio.

XVI. Emergency Communications

Audubon radios are the first means of communication in the event of an emergency. While working on Audubon property, contractors/vendors or their supervisors may be given a radio. It is important to listen for emergency announcements and keep the radio clear during such situations. Audubon Zoo has a public address system used in an emergency to communicate with guests or contractors that do not have a radio. See included Emergency Action Plan for further information.

XVII. Contractor Access & Identification

While working on Audubon property, all contractors are required to be easily identifiable with their employer. Either apparel with company name/logo or Company business card clipped to shirt as an ID badge will be required.

The contractor is to provide a list of names of workers to Audubon before commencement of work. -All contract personnel (all contractors, contractor representatives and vendors) are required to check in DAILY at Gate 1 before beginning any work on facility premises. This includes all properties associated with the Zoo & Park.

All contract personnel will be required to provide Identification before gaining admittance. Upon check in, the contractor will receive a temporary badge. This badge must be worn and visible.

Vendor badges will be returned to base at the conclusion of every workday. -Contract personnel are prohibited from venturing outside of their designated work area. No wandering, or self-guided tours allowed. -Contract personnel shall only utilize restrooms, break areas and vending areas as determined by Audubon representative before commencement of work. -

Noncompliance with the above stated rules may result in removal and banning of individuals and businesses from premises.

XVIII. Animal Welfare

Many of the animals in our collection are sensitive to loud noises. Any work that will produce loud noises should be discussed in advance with the Audubon Project Manager, Contactor and Animal Staff to ensure a plan is agreed upon to reduce the likelihood of impacting the animals. Loud machinery, something out of the ordinary, can cause acute stress in animals.

XIX. Construction in Occupied Buildings

The Contractor is responsible for communicating timelines where occupants may be affected. The Contractor must inform occupants of any potential hazards associated with work activities. The contractor shall set clear boundaries and barriers to separate the construction area and occupied areas. The contractor shall establish a plan to manage noise, dust, and other potential disruptions. The contractor shall have an emergency response plan for incidents and perform regular safety inspections to ensure workers and occupants are safe from construction activities.

AUDUBON ZOO
EMERGENCY ACTION PLAN
Emergency Contact #s

General Curator Cell	513-503-5441
General Curator Office	504-861-6160
Facilities 1 Cell Phone	985-860-2607
Facilities 1 Office	504-212-5322
Zoo Safety	985-774-7549
Zoo & Park Director Cell Phone	504-491-5343
First Responder Cell Phone	504-235-5412
First Responder Office	504-212-5201
Public Relations Cell Phone	985-290-0231
Security Cell Phone	504-628-3988
Security Office	504-212-5329
MSDS Online	1-888-362-7416
CHEMTREC (Chemical Information)	1-800-424-9300
Entergy (Gas & Electric Emergency)	1-800-968-8243
Harbor Police	504-891-7585
LA Poison Control	1-800-222-1222
Ochsner Emergency Room	504-842-3000
Police & Fire Emergency Services	911
Public Belt (Train Emergency)	504-896-7442
Sewerage & Water Board (Emergency)	504-529-2837
United States Coast Guard (Emergency)	504-589-6225

Emergency Communications

1. Audubon Radios are the primary means of communications in the event of an emergency.
2. Audubon uses a communication system that will send notice in the event of an emergency to staff via text, call and email.
3. Contractors are prohibited from having contact with the media on behalf of or regarding Audubon. All media requests should be directed to the Public Relations department.
4. Audubon Zoo uses a PA System to communicate emergencies to guests and contractors.

Common Radio Codes

"10-4"	<i>Message received</i>
"10-9"	<i>Repeat message</i>
"10-19"	<i>Return to base station or other specified location</i>
"10-20"	<i>What's your 20? - What's your location?</i>

ANIMAL ATTACK PROTOCOL

1. If anyone is attacked by a dangerous animal, call for help using the radio or cell phone. Try your best to state your location and the animal involved. If use of the radio or cell phone is prohibited, yell for help. Other animal staff members can assist by trying to lure the animal away and/or shifting the animal into another enclosure if they can do so safely. Otherwise wait for assistance from the Hospital and Shooting Team. Do not make yourself another victim!
2. Hospital staff and the Weapons Team will respond with the appropriate equipment. In the event that an animal has to be destroyed to preserve human life, Zoo One or the senior Shooting Team member will make the decision. The Shooting Team will then determine when it is safe to shoot.
3. First Responder will respond with the appropriate equipment for human medical needs. If it is obvious that an ambulance will be needed for transport to the ER, a staff member on site should call 911.
4. **All routine radio traffic should be discontinued until an “all clear” is announced.**

*When interacting with guests during an animal attack be truthful, polite, and discreet. State only what you know, and refer further questions to Public Relations, Curator, or Zoo Director.

ANIMAL ESCAPES

In the event that an animal escape “code” is called, non-animal staff should do the following:

1. Keep the radio clear.
2. Perform any duties described in the Animal Escape Procedure (e.g., close gates, get visitors to safety, etc). See attached Animal Escape Procedure for reference.
3. Hold positions unless instructed by the Animal Department or given the all clear. Depending on the severity of the situation, other staff and volunteers can be used to control onlookers or track an escaped animal.

If a non-animal department staff member makes the initial sighting of the animal:

1. If you know the correct name of the animal, broadcast it and its location over the radio. The first animal staff member on the scene will confirm the identity of the animal and will broadcast the appropriate code over the radio.
2. If you do not know the correct name of the animal, give the best description possible of the animal and its location.
3. Get to safety or assist in moving others to safety or carry out directions assigned to you by the animal staff member on the scene.

*When interacting with visitors during a code situation be truthful, polite, and discreet. State only what you know, and refer further questions to Public Relations, Curator, or Zoo Director.

Code Red – dangerous animal escape

Code Yellow – potentially dangerous animal escape

EXTRACTION PROTOCOL

HUMAN IN ANIMAL EXHIBIT

1. If a guest is observed in an animal exhibit or attempting to get into an exhibit, immediately ask the guest to exit. Notify Security, Animal Staff, Hospital, and First Responder of the situation and the location. If you are without a radio, contact the nearest employee or work site with a radio or telephone and proceed as above.
2. Do not go into the exhibit! You may assist the intruder as he or she exits the exhibit, but do not place yourself in danger.
3. Animal staff and Hospital will respond with the appropriate equipment. If in a dangerous animal exhibit, the shooting team will respond as a back-up to the animal staff.
4. First Responder will respond with the appropriate equipment for human medical needs.
5. Animal staff will attempt to coax the animal away from the intruder. In the event an animal has to be destroyed to preserve human life, the Senior Curator on scene will make the decision. The shooting team will then determine when it is safe to shoot.
6. If the event occurs at night, after the Zoo is closed, tell the intruder to exit the exhibit. If unresponsive to the command, or the intruder is unable to respond, immediately notify Security who will determine if any additional resources are needed.

BOMB THREATS

1. Treat any bomb threat as real. Try to obtain as much information from the caller as possible. Terms, wording, and background noises are important and should be noted.
2. Notify Security via radio or cell phone (504-628-3988). Security will notify the New Orleans Police Department.
3. Security will evacuate staff and guests at least 1000 feet from the targeted area. Staff in the area should assist in the evacuation of guests and coworkers.
4. Security will establish an emergency operations center.
5. An “all clear” will be announced by Security when the situation is over.

Note: If you ever receive or discover a suspicious package or foreign device, do not, under any circumstances, tamper with it. Immediately contact Security.

*When interacting with guests during a bomb threat situation be polite and discreet. State only that there is a problem in the area, and refer further questions to Public Relations or Zoo Director.

CRIMINAL ACTIVITY

1. Any contractor or vendor who witnesses any criminal activity occurring on grounds should notify Security immediately via radio or cell phone (504-628-3988). Be ready to provide the following information about the suspect: race, sex, approximate age, clothing description, distinguishing features, and the direction in which the person or people were traveling. Pay attention to the area and identify potential witnesses. Security will respond and determine if NOPD should be notified.
2. Any contractor or vendor encountering violent behavior should immediately notify Security. Physical intervention in a violent situation (such as a fight) is not recommended. Keep guests away to prevent injury, and advise combatants to stop.
3. Report theft to Security as soon as possible.
4. Report any threats made to you immediately. Zoo Security must be informed as soon as possible.

INJURIES

1. Ascertain the type of injury or illness.
2. Notify Audubon First Responder, by radio, of the location of the patient and his or her injury or illness. If you are without a radio, contact First Responder by cell phone (504-235-5412). Do not hang up until all information has been relayed, and First Responder had told you that he/she is on the way.
3. Stay with the patient until the First Responder arrives and releases you.
4. Do not state the patient's name over the radio.
5. Do not move a patient who has fallen or is unconscious unless he or she is in grave danger of further injury.
6. If the injury or illness takes place after hours, and there is no First Responder on grounds, call Security on radio or via cell at 504-628-3988. If the injury is life-threatening and occurs before or after hours when there is no first responder on grounds, immediately call 911. Then contact Security to inform them of the situation.
7. In the case of serious injuries, the First Responder and Security will need to communicate regarding the location of the patient and ambulance arrival. Security will meet the ambulance when it arrives and escort the driver to the location of the injury. **In these instances, please stay off the radio until the "all clear" has been given.**

ACTIVE SHOOTER

1. An Active Shooter is an individual actively engaged in killing or attempting to kill people using firearms.
2. Using your Radio announce "Code Silver". State your location and repeat three times.
3. Call Security or 911 when safe to do so!!!! Be prepared to provide location, number of shooters, physical description, type of weapons and any potential victims. EVACUATE
4. Have an escape route and plan in mind
5. Leave your belongings
6. Keep hands visible. HIDE OUT
7. Hide in an area out of the shooter's view
8. Block Entry to your hiding place and lock the doors
9. Silence your cell phone and/or pager
10. RUN, HIDE, FIGHT
11. When law enforcement arrive, stay calm, keep your hands empty and clear, avoid pointing and yelling. Do not stop to ask officers for help or directions.

FIRE

1. When a fire is detected that cannot be put out by use of a fire extinguisher, go to the nearest fire alarm station and activate the alarm by pulling the lever. If you cannot find a fire alarm station, immediately notify Security via radio or cell phone (504-628-3988).
2. All routine radio traffic should be discontinued.
3. If safe to do so, confine the fire in the affected area: close all doors and windows, shut off all air conditioners and ventilation systems. Shut off all water hoses and faucets.
4. Evacuate all guests and all staff not involved in fire control at least 100 feet away and upwind of the affected areas. If you get caught in the smoke, get down and crawl to the nearest exit. Do not use elevators.
5. Security will clear fire lanes and open gates for responding emergency vehicles. Emergency vehicles should enter Zoo grounds from the Administration gate for fires in the Administration building, Children's Zoo, South America, Commissary, Hospital, and Asian Domain. Emergency Vehicles should enter the Tea Room gate for fires in the Odenheimer Complex, Primates, Sea Lions, Reptiles, and African Savanna. Emergency Vehicles should enter Swamp gates for fires in the Swamp and Jaguar Jungle.
6. All supervisors in affected areas must account for all of their employees. Report to Security any workers who are not accounted for.
7. Do not re-enter a building until an "all clear" has been given.

*Be prepared. Everyone should familiarize themselves with the locations of fire extinguishers, as well as the evacuation routes for their areas.

HAZARDOUS CHEMICAL SPILLS

Chemical hazards can create dangerous situations including fire, explosions, and health problems. It is important that whenever a chemical spill or strong odor is detected, safety precautions must be taken. The nature of operating a zoo requires a variety of chemicals to maintain the facilities. The Zoo is also located next to a railway, river, and roadway; all of which transport many hazardous chemicals. Many of these substances have differing levels of toxicity, which could pose health hazards.

1. Any contractor or vendor who discovers a hazardous chemical spill should immediately evacuate the area and notify Security, and his or her supervisor. Security will contact First Responder if medical attention is needed. Security will also contact the Fire Department if needed. Security will also notify Facilities.
2. Do not approach the chemical spill. Divert pedestrian traffic away from the area. Whenever possible, keep people upwind of the spill.
3. Do not dispose of any chemicals without first checking the MSDS for proper disposal. Do not attempt to clean up the spill if the quantity spilled is greater than one liter or if the substance is unknown. Contact Security and Facilities for disposal assistance.
4. All qualified staff who are HAZ-WOPER certified will respond for initial assessment.

LOST CHILDREN

1. Remain calm and reassure the child (or the adult looking for the child). Stay with them. Call Security at 504-628-3988.
2. Notify Security and all staff by radio. Specify whether you are with the adult and looking for the child or vice versa. Describe the child by race, sex, age, his or her attire, name of school, location found/last seen, and any other helpful attributes.
3. If a prompt resolution does not take place, ask Security to meet you.
4. Do not leave a child without proper supervision.
5. Lost children will remain with Security until reunited with a parent or guardian.

NATURAL GAS LEAKS

1. If you smell gas or suspect a leak, cease all operations. Immediately alert Facilities Director via radio or cell phone or call (504-722-4293) to notify Plumber. State the problem, the exact location, and approximately what time the gas leak started (if known).
2. Move guests and staff at least 300 feet (100 meters) away from the affected area. Do not use elevators.
3. Security will alert Facilities and the Fire Department.
4. Facilities will notify Entergy.
5. Do not reenter the building until an “all clear” is announced by Security.

SEVERE WEATHER

1. Since the Zoo is an outdoor environment with limited building space, severe weather constitutes a special problem in terms of protecting visitors and staff. Contractors and their workers should exercise good judgment and common sense when weather deteriorates creating a risk to themselves and visitors.
2. A “weather watch” indicates conditions exist in which severe weather may occur. Everyone should continue their normal duties but should prepare their work sites to accommodate those seeking shelter. Each employee should familiarize themselves with appropriate shelter buildings in his or her area and the Zoo as a whole.
3. A “weather warning” indicates that severe weather has been sighted and there is a risk to the area. Everyone should seek shelter immediately, including guests.
4. Security will monitor the National Weather Service broadcasts and update contractors on the status of the emergency.
5. Very few buildings on Zoo grounds are immune from severe weather, especially a tornado. In general, buildings constructed of concrete blocks with basements offer better shelter than frame buildings. Areas with large amounts of glass windows and skylights should be avoided. Contractors working on the back road should move to the Audubon Administration building. All other contractors and vendors should seek the safest nearby structure.
6. An all clear will be announced once it is safe for everyone to exit buildings.

VENOMOUS SNAKEBITE

Snakebite Signals:

Any bite from a venomous snake is dangerous and requires prompt emergency treatment. **All persons who might be involved in assisting Reptile House personnel, Swamp Exhibit personnel, telephone operators, Security personnel, staff members, etc. should study the full procedure carefully and be thoroughly familiar with procedures. The full procedure can be found on the employee intranet.**

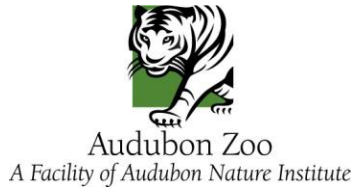
1. Snake Bite Alarms are located in Swamp and reptile Buildings.
2. Once an alarm is activated, notification is sent to a specific group via phone, text and email identifying the location of the snake bite.
3. First Responder will respond to provide medical care until EMS arrives.
4. The first person on the scene will contact 911.
5. Upon arrival of EMS, the snake bite victim will be transported to University Medical Hospital with antivenom and medical history of the victim.
6. Please stay OFF your radio unless you have been specifically asked to help or until the “all clear” is given.

LOSS OF LIFE

1. Immediately notify Security and then call 911.
2. Personal Protective Equipment such as gloves should be used to protect yourself from Blood Borne Pathogens.
3. Do not touch or tamper anything with the scene.
4. Security will respond and will call for Crowd Managers to assist in securing the scene until police arrive.
5. Security will use yellow tape or barricades to block off the area and keep onlookers away.
6. Direct all media questions to Public Relations.

CROWD MANAGEMENT

1. Audubon has certified crowd managers trained in crowd management.
2. Security or First Responder should call for “All Crowd Managers” to respond when a situation arises that requires additional staff assistance in controlling a scene or securing a perimeter.
3. Crowd Managers should respond to the scene if available to assist.



Golf Cart and Service Equipment Policy

PURPOSE:

The purpose of this policy is to establish a clear set of procedures and guidelines regarding the operating of golf carts and service equipment on Zoo and Park grounds for the safety and protection of staff, guests, and property, before open hours, during open hours, and load-in/load-out for events.

RULES AND PROCEDURES:

- 1. DO NOT TEXT OR USE A MOBILE PHONE WHILE DRIVING A GOLF CART OR SERVICE EQUIPMENT!**
- 2.** Golf Carts/Service Equipment driven on Zoo grounds are permitted only on the "Approved Service Routes" (see attached map) during open hours. Golf Carts & Service Equipment are permitted throughout the Zoo during closed hours unless otherwise specified in this policy.
- 3.** During event set up and break down, golf carts and service equipment are allowed an exemption to the "Approved Service Routes" during open hours. Golf carts and service equipment may use paved pathways with caution for guests. When conditions permit, golf carts and service equipment may drive off the paved pathways onto the grass. Matting or plywood may be required to ensure no damage to the grounds.
- 4.** Carts/service equipment are not permitted on boardwalks in the Zoo at any time. For this policy boardwalks are considered wooden structures expanding the length of a wet land or

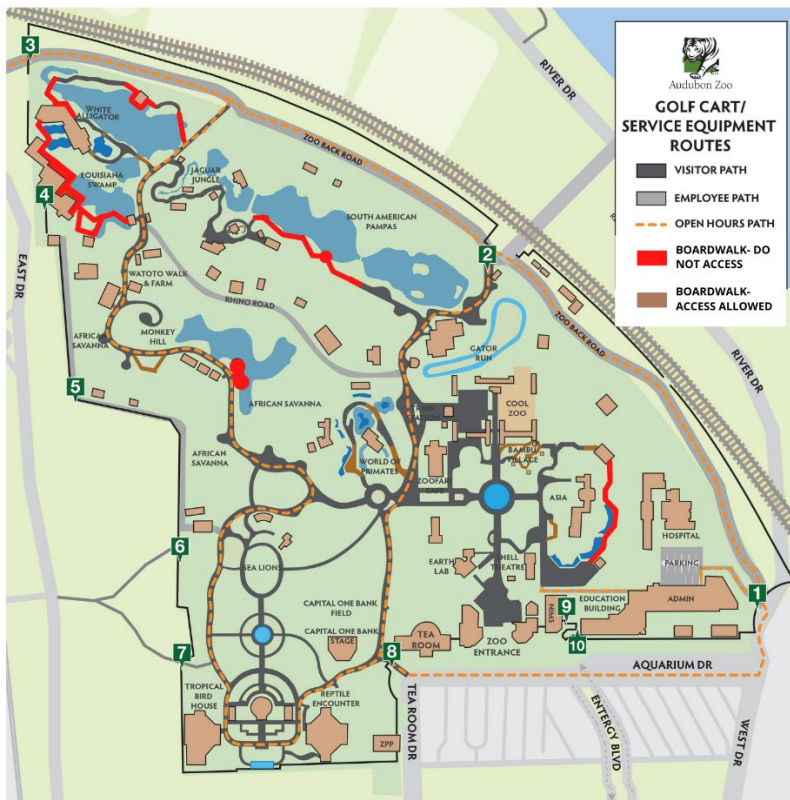
body of water longer than 20 feet. There are three areas with Boardwalks; Swamp Boardwalk, Asia Boardwalk, and South America Boardwalk.

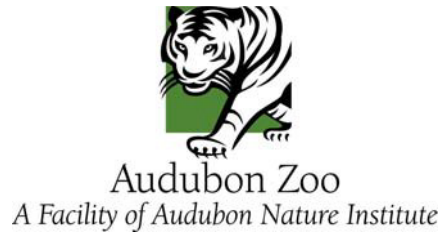
5. Golf Carts and Gators (without trailers or heavy loads) are permitted on bridges during closed hours. Pro Gators, Kubotas, and any other service equipment weighing more than 2000 (GVWR) are **prohibited** unless there is a danger to life of a person or animal. Vehicles are also prohibited without prior approval from a structural engineer. For this policy bridges are considered wooden structures expanding the length of a wet land or body of water shorter than 20 feet.
6. Carts/Service Equipment are not permitted on the front plaza during open hours but may be permitted during load-in/out of special events, or other facility maintenance functions.
7. Golf cart/service equipment operators are expected to observe the Capital One Tree Policy. This is for the protection of the historic oak trees, and irrigation system.
8. Golf carts/service equipment driven on city streets must observe all municipal regulations and follow all posted traffic signs within the zoo/park.
9. Carts/service equipment should be operated at a safe speed for the condition of the road and environment (i.e. people, weather conditions, uneven surface).
10. Pedestrians always have the right-of-way.
11. Approach sharp/blind corners and building entrances with caution and reduce speeds. Maintain safe operating speeds, including speeds appropriate for reacting to pedestrian traffic, curves, blind corners, other vehicles and weather conditions.
12. While operating carts in Audubon Park, you should drive in the direction of the flow of traffic which is one-way. Even if this means, going around the park to get to your location. If there is a need to go against traffic, do so at an **EXTREMELY S L O W** speed. Stay in the bike lane, stopping when needed for bikes and do not drive on the grass.
13. Check for people and obstructions before driving in reverse.

- 14. Carts are not to be driven with more passengers than the provided seating. Never allow passengers to hang-on or ride in cargo bays. Secure all loads to the cargo bay before operating the cart.**
15. Carts/service equipment without headlights shall not be operated after dark or in low visibility conditions.
16. Carts/service equipment left unattended in public areas must exhibit the following:
- brakes engaged
 - *secure tools and hazardous materials.* Operators are responsible for the cart/service equipment during the entire time it is in their possession.
17. Conduct a pre-trip inspection by checking that all tires are properly inflated and there are no loose objects hanging off the cart.
18. Golf carts/service equipment should only be operated from the driver's side.
19. Wear seat belts at all times if installed.
20. Keep your entire body in the cart/service equipment at all times...the same applies to all passengers. This includes your FEET!
21. Avoid steep grades if possible.
22. Take malfunctioning carts/service equipment out of service immediately using lockout/tagout measures.
23. Do not attempt to fix a malfunctioning or inoperable cart/service equipment as all repairs shall be conducted by a qualified maintenance/repair technician.
24. Employees will be properly trained in the basic operations of golf carts/service equipment by their supervisors. Please see attached daily checklist required to be completed by the operator.
25. Operators must promptly report any accident involving a golf cart/service equipment to their immediate supervisor. If an injury was sustained, an accident/injury report is to be completed by an Audubon's EMT staff, the operator, and the operator's supervisor. If an accident involves an injury or property damage, an accident report must be

completed at the time of the incident by Zoo Security (628-3988). The employee involved must also submit to a mandatory drug test. Audubon's EMT staff or Human Resources will coordinate the mandatory testing.

26. Staff are not permitted to provide rides to guests for transportation on golf carts or service equipment as a general rule. There are exceptions for EMT's during medical emergencies and Development or EVP's providing behind the scene or special tours. Contractors are permitted to ride as passengers on golf carts and service equipment.





LIVE OAK TREE POLICY

Audubon Zoo and Park

Purpose:

The purpose of this policy is to educate Audubon staff, contractors and vendors of the proper use of Audubon property to ensure the integrity and health of the historic live oak collection.

Policies and Procedures:

- All Audubon staff are responsible for educating vendors of this policy as well as adhering to the below policies.
- All event sponsors are highly encouraged to have an Audubon representative present during the entire vendor or contractor load in/out process. This representative is responsible for properly explaining this policy to all vendors and contractors and monitoring their adherence. Zoo Security will serve as back-up should the representative feel that a vendor or contractor refuses to adhere to the policy that has been explained by the representative. Security should only be contacted after the representative has made a second attempt to explain this policy.
 - To assist the representative in directing traffic, yard signs which state “No vehicles or heavy equipment beyond this point”, are available for use by all event sponsoring departments. These signs can be found in the Operations offices and are available for use at any time.
- Tent stakes are not allowed in the Capital One Field or Oak Grove. Stakes cause damage to the roots of trees, irrigation systems, and underground pipes and electric lines.

- Staking tents also becomes a serious safety hazard.
- Vehicles are only allowed on grassy areas within the fields to unload or make deliveries. Please see the attached map for the acceptable vehicular traffic routes for Capital One Field. Please do not deviate from the accepted routes. These routes allow for all major areas of the Field to be accessed without damage to the trees, irrigation system and underground pipes and electric lines.
- Vehicles are to unload and then immediately leave the Capital One Field and Oak Grove. Vehicles should not remain in the areas for an extended period of time.
- Mulch rings around trees are never to be driven on by neither vehicles nor golf carts. These rings are designed to cover the trees' underground root systems. Driving within these mulch rings may cause severe damage to trees.
- Live oak tree limbs naturally grow downward. This may cause disruption to event set up and layout. It is the responsibility of the event sponsors to coordinate with the Horticulture and Trees Department to establish the best course of action. In some instances, the tree may be trimmed. Both parties must establish logical and considerate compromise.
- Generators, Crowd Pleasers and other heavy equipment typically discouraged from use in Capital One Field and Oak Grove may be permitted under special circumstances only with consultation regarding placement from the Horticulture and Trees Department.
- All special event logistics deviating from this policy should be communicated to the Operations and Horticulture and Tree Departments before any finalized decisions, plans, or contracts are made.

Thank you for cooperating with this policy to ensure the health and longevity of the historic live oak trees here at Audubon Zoo and Park.

Animal Escape Policy

An animal escape is defined as an animal getting out of the area that normally contains it or, in the case of a trained or handled animal being used out of its enclosure, getting away from the person who controls it. An escaped animal could merely be a minor nuisance or could be an extremely dangerous situation that could lead to human or animal fatalities. An established written escape procedure, a well-trained staff, common sense, and a controlled rational reaction all contribute to the rapid, safe recapture of an escaped animal.

The number of staff needed will vary according to the situation. Two separate procedures will be given – a Working Hours Procedure (7:30am-5:30pm) and an After Hours Procedure. The Work Hours Procedure will be given in a condensed version form for familiarity and also in a detailed version for clarity.

Non-Animal Department Zoo staff and volunteers will follow a separate procedure. They will be instructed to do four main things:

- 1) Keep the radio clear.
- 2) Perform any duties described in their Escape Procedure (e.g., close gates, get visitors to safety, etc.)
- 3) Hold their positions unless instructed by the Animal Department or given the all clear. Depending on the severity of the situation, other zoo staff and volunteers can be used to control onlookers or track an escaped animal.
- 4) Security Staff should make sure the Tea Room and Admin Gates are secure and manned so that no one enters the zoo during an animal escape.

Communication:

Animal escapes will be communicated in the following ways:

- Text Message will be sent to staff who have an Audubon issued cell phone with Texting capabilities by the Emergency Texting Group.
- Telephone Message - an automated phone message will be sent to desk phones.
- Radio transmission - it is highly recommended that radios be turned on and monitored if you/your department have one on a daily basis.

If a non-animal department staff member makes the initial sighting of the animal:

- 1) If you know the correct name of the animal, broadcast it and its location over the radio. The first animal staff member on the scene will confirm the identity of the animal and will broadcast the appropriate code over the radio.
- 2) If you do not know the correct name of the animal, give the best description possible of the animal and its location.
- 3) Get to safety or assist in moving others to safety or carry out directions assigned to you by the animal staff member on the scene.

****Note:** At the time of a dangerous animal escape there is a good chance that there will be one or more contractors, vendors, or other outside parties performing work on grounds. Those employees who are located in the vicinity or are aware of the location of the outside parties please make sure they are alerted of the situation and directed to safety.

Condensed Version

Regular Work Hours Procedures 8am-5:30pm

I. Initial Sighting of Escaped Animal

- a. Call for assistance – use radio, cell phone or voice
- b. Determine appropriate Escape Code:
 1. **Code Red:** dangerous animal escape
 2. **Code Yellow:** potentially dangerous escape
- c. Broadcast “Code” over radio – describe animal, give other pertinent information – **REPEAT THREE TIMES.**
- d. Keep animal in sight, follow safely, **DO NOT CHASE**, and wait for assistance. Update movement and actions as necessary.

II. Animal Department Response

- a. **Code Red:**
 - Zoo 1, Section C/AC, Shooting Team and Hospital Staff – go to site in an enclosed vehicle using extreme caution.
 - First Responder on standby
 - All other Animal Staff secure gates, get everyone to safety, and stand by.
- b. **Code Yellow:**
 - Zoo 1, Section C/AC, Section Keepers, Hospital Staff – go to site using caution.
 - Shooting Team on standby
 - First Responder on standby
 - All other Animal Staff secure gates and stand by.
- c.

III. Resolution of Escape Situation

- a. Curator 1 (Code Red, Yellow) or affected Section Supervisor will announce the situation is over.
- b. Carry out any instructions given at that time.
- c. Any media or public inquiries must be referred to Managing Director or Public Relations. Any visitor complaints or concerns should be referred to Managing Director or his/her designated representative(s).
- d. All Animal Staff involved should meet with their supervisor and give a detailed account of the incident, their involvement, etc. The supervisor should then fill out an “Animal Escape Incident Report”, have it signed by all staff that were involved, give the original to GC Admin Asst., one copy to the Curator of the animal involved and keep one copy for their files.

Social Networking/Online Communication Policy

Methods of self-expression are prevalent in today's electronic society. Audubon Nature Institute respects your right as an Employee, Volunteer, Contractor, Vendor, or Intern to use these mediums during your personal time. However, as an Audubon Nature Institute Employee, Volunteer, Contractor, Vendor, or Intern, you must adhere to a strict code of professional conduct regarding Social Networking/Online Communication. This does apply to online communications during your personal time and your personal computer.

Social Networking/Online Communication is defined as communication via web sites, email, chat rooms, social media (Facebook, Twitter, Instagram, etc.), podcasting, blogs, or any other kind of communication distributed digitally or electronically.

Even well-meaning posts can inadvertently cause damage; for example, discussing a negative interaction with a guest, or commenting on a new animal acquisition or death of a beloved animal before it is announced to the public. People reading such information may wrongly construe the message as a representation of Audubon policy or that the message contains a complete set of facts about internal business.

PROPRIETARY INFORMATION

Audubon Nature Institute allows Employees, Volunteers, Contractors, Vendors, and Interns access to certain information relating to affairs, employees, volunteers, guests, partners, vendors, sponsors, donors or other affiliates (Proprietary Information) to enable you to perform your job responsibilities.

This Proprietary Information includes, but is not limited to, information on animal health and behaviors, animal births and deaths, sponsorships, donations, financial information, visitor interactions and scientific research. Regardless of whether you identify yourself in online communications as an Audubon employee or not, you may not discuss Proprietary Information.

Our website, www.auduboninstitute.org, carries detailed information and news that has been made public. If you are unsure if an announcement has been made, check the Media/News link on the website.

LOGO USE

You may not use company logo or materials without first obtaining permission from the Director of Development Marketing Services.

PHOTOGRAPHY

Publication of photographs in any area not on a visitor pathway is not permitted without prior authorization from Public Relations. This includes photos taken with your personal camera. Photos must be taken from a visitor pathway to be shared by you or must receive prior approval. Any work performed as an Employee, Volunteer, Contractor, Vendor, or Intern, including all photographs and videos, are property of Audubon Nature Institute.

CONTROVERSIAL POSTINGS

If any unethical or controversial posting is reported to Audubon Nature Institute, management reserves the right to view the site and take the necessary action. Audubon may request that you suspend your website or weblog activity if it is believed this action is necessary or advisable. Failure to follow this policy may result in corrective action, up to and including termination.

Questions regarding this policy or any matter related to social networking/online communications that this policy does not address, should be directed to your supervisor, or Audubon's Human Resources Department, as appropriate.

SPEAKING TO MEDIA

All media representatives' requests must be directed to the Director of Public Relations. Employees, Volunteers, Contractors, Vendors, and Interns are not authorized to speak to media without approval from the Director of Public Relations.

SECTION 01 21 00 ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.

1.02 RELATED REQUIREMENTS

- A. Section 01 29 00 - PAYMENT PROCEDURES: Additional payment and modification procedures.

1.03 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final installation of systems described by an allowance must be completed to avoid delaying the Work.
- B. At the Architect's request, obtain proposals for each allowance. Include recommendations that are relevant to performing the Work.

1.04 ACTION SUBMITTALS

- A. Submit proposals for purchase of systems included in allowances, in the form specified for Change Orders.

1.05 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentations to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.06 COORDINATION

- A. Coordinate allowance items with other portions of the Work.

1.07 LUMP SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to materials under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under and allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.08 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

1.09 ALLOWANCES SCHEDULE

- A. Include the stipulated sum of \$15,000 for purchase, delivery, and install of a shade element for within the Komodo Habitat.
- B. Include the stipulated sum of \$15,000 for additional Komodo Habitat Theming
- C. Include the stipulated sum of \$25,000 for purchase, delivery, and install of a shade element for the guest side of the Komodo exhibit.
- D. Include the stipulated sum of \$5,000 for purchase, delivery, and install of an awning element for the guest side of the Aldabra view window.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine materials covered by an allowance promptly on delivery for damage or defects. Return damaged or defective materials to manufacturer for replacement.

3.02 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 01 21 00

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 01 40 00 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject the Contractor's measurement of work in place that involves use of an established unit price, and to have this work measured at the Government's expense by an independent surveyor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Repointing of Brick.
 - 1. Description: Repoint existing brick where indicated on drawings."

- 2. Unit of Measurement: /square foot of brick repointed.
- B. Unit Price No. 2: Replacement of Slate Tiles at roof.
 - 1. Replace existing slate tiles at roof.
 - 2. Unit of Measurement: /square foot of slate tiles replaced.
- C. Unit Price No. 3: Copper Gutter replacement.
 - 1. Replace copper gutter.
 - 2. Unit of Measurement: /linear foot of gutter replaced.
- D. Unit Price No.4: Vehicular Concrete Paving.
 - 1. Vehicular Concrete paving as noted in Civil Drawings.
 - 2. Unit of Measurement: /square foot of paving installed.
- E. Unit Price No.5: Pedestrian Concrete Walkway.
 - 1. Pedestrian Concrete Walkway as noted in Civil Drawings.
 - 2. Unit of Measurement: /square foot of walkway installed.

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Statement indicating why specific substitution benefits the owner.
 - c. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - d. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - e. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - f. Samples, where applicable or requested.
 - g. Certificates and qualification data, where applicable or requested.

- h. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - i. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - j. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - k. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - l. Cost information, including a proposal of change, if any, in the Contract Sum.
 - m. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - n. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.

- e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
 - j. Only one request for substitution for each product per contractor will be considered. When substitution is not accepted, provide specified product.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SUBSTITUTION REQUEST FORM

Project: _____ Architect's Project Number: _____

Substitution Request Number: _____
To: _____ Date: _____

From: _____
Re: _____ Contract For: _____

Section Title: _____ Description: _____
Section No.: _____ Page: _____ Article/Paragraph: _____

Trade name, model number, and name of proposed substitution:

What effect does substitution have on applicable code requirements?

Differences between proposed substitution and specified item? (*Use attachment for additional space, if required.*)

Manufacturer's warranty on proposed and specified items are:

Same Different
(*Explain on attachment.*)

Reason for requesting substitution:

Cause Convenience

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: _____ ☐ No ☐ Yes [Add] [Deduct] days.

Will the Undersigned pay for changes to the building design, including engineering and detailing costs,
caused by the requested substitution? Yes No

Enclosed data consists of:

Catalog Reports	Drawings Sustainability Criteria	Product Data	Samples	Tests

List availability of maintenance service and replacement materials.

State effects of substitution on project sustainability goals:

Any license fees or royalties: Yes No

UNDERSIGNED certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product, including meeting Sustainability Requirements.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts as applicable is available.
- Proposed Substitution will not affect or delay Progress Schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived by the Contractor.
- Proposed substitution does not affect dimensions or functional clearances.
- Payment will be made for changes to building design, including architectural or engineering design, detailing, and construction costs caused by proposed substitution.
- Coordination, installation, and changes to the Work as necessary for accepted substitution will be complete in all respects.

Submitted by:

Signature _____

Firm _____

Address _____

Date _____

Telephone _____

For use by Architect:

Accepted: Accepted As Noted:

Not Accepted: Received Too Late:

Date _____

Remarks: _____

Approved by (C.M.)

By: _____

END OF FORM

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 01 3100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 or form acceptable to the owner and Architect.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or form acceptable to the owner and Architect.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

- a. Related Specification Section or Division.
- b. Description of the Work.
- c. Name of subcontractor.
- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
6. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
7. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
8. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Sustainable design action plans, including preliminary project materials cost data.
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.
- B. Related Requirements:
 - 1. Section 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.
 - 4. Section 01 9113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.
- C. Coordination Drawings: Electronically produced drawings that overlay multiple scopes of project-specific work on one drawing sheet, to scale, for the purpose of coordinating the installation of scopes using horizontal and vertical controls.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.
- C. Coordination drawings.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 3300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of AIA Document C106 or an Agreement form acceptable to Owner and Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified. RFI numbers are to begin with "001", and shall not be duplicated.
1. Architect will return RFIs submitted to Architect or their Consultants by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

- a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
 - C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in PDF format.
 - D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
 - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
 - 1. Web-based Project software site includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.

- c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.
 2. Provide up to ten web-based Project software user licenses for use of Owner, Owner's Commissioning Authority, Architect, and Architect's consultants. Provide one hour of software training at Architect's office for web-based Project software users.
 3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
 4. Provide the following web-based Project software packages under their current published licensing agreements:
 - a. Procore Technologies, Inc.
 5. Project Closeout: Architect will determine when to terminate the service for the project. Contractor is responsible for obtaining archive copies of electronic .PDF files from the service provider and transmitting copies to the Architect and Owner.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.
 4. Cost: The cost of the service is to be paid by the Contractor; include the cost of the service in the Contract Sum.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Submission of list of Subcontractors, list of Products, Schedule of Values, and construction schedule.
 - o. Sustainable design requirements.
 - p. Preparation of Record Documents.
 - q. Use of the premises.
 - r. Work restrictions.
 - s. Working hours.
 - t. Owner's occupancy requirements.
 - u. Responsibility for temporary facilities and controls.
 - v. Procedures for moisture and mold control.
 - w. Procedures for disruptions and shutdowns.
 - x. Construction waste management and recycling.
 - y. Parking availability.
 - z. Office, work, and storage areas.
 - aa. Equipment deliveries and priorities.
 - bb. First aid.
 - cc. Security.
 - dd. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Sustainable Design Requirements Coordination Conference: Architect will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner Architect, and Contractor.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
 - a. Sustainable design Project checklist.
 - b. General requirements for sustainable design-related procurement and documentation.
 - c. Project closeout requirements.
 - d. Role of sustainable design coordinator.
 - e. Construction waste management.

- f. Construction operations and sustainable design requirements and restrictions.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the

- meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for completing sustainable design documentation.
 - f. Requirements for preparing operations and maintenance data.
 - g. Requirements for delivery of material samples, attic stock, and spare parts.
 - h. Requirements for demonstration and training.
 - i. Preparation of Contractor's punch list.
 - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - k. Submittal procedures.
 - l. Coordination of separate contracts.
 - m. Owner's partial occupancy requirements.
 - n. Installation of Owner's furniture, fixtures, and equipment.
 - o. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- F. Progress Meetings: Conduct progress meetings weekly.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Status of sustainable design documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.

- 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- G. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of RFIs.
 - 14) Proposal Requests.
 - 15) Change Orders.
 - 16) Pending changes.
 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Section 01 2900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
 - 2. Section 01 3300 "Submittal Procedures" for submitting schedules and reports.
 - 3. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Unusual Event Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including interim milestones.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review submittal requirements and procedures.
 7. Review time required for review of submittals and resubmittals.
 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 10. Review and finalize list of construction activities to be included in schedule.
 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 6. Commissioning Time: Include no fewer than 15 days for commissioning.
 7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Use of premises restrictions.
 - c. Seasonal variations.
 - d. Environmental control.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 CPM SCHEDULE REQUIREMENTS

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Commissioning.
 - k. Punch list and final completion.
 - l. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

- a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, sustainable design documentation and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.9 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events (see special reports).
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Construction Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Construction webcam.
- B. Related Requirements:
 - 1. Section 01 7700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 2. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 3. Section 02 4119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name of Architect.
 - c. Name of Contractor.
 - d. Date photograph was taken.
 - e. Description of location, vantage point, and direction.
 - f. Unique sequential identifier keyed to accompanying key plan.
- C. Video Recordings: Submit video recordings within seven days of recording.
 - 1. Submit video recordings on CD-ROM or thumb drive. Include copy of key plan indicating each video's location and direction.
 - 2. Identification: With each submittal, provide the following information in file metadata tag:

- a. Name of Project.
- b. Name of Architect.
- c. Name of Contractor.
- d. Date video recording was recorded.
- e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 QUALITY ASSURANCE

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time from camera.
- E. File Names: Name media files with date and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 50 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 50 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Periodic Construction Photographs: Take 50 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- E. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

1.6 CONSTRUCTION VIDEO RECORDINGS

- A. Preconstruction Video Recording: Before starting demolition, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
 1. Flag construction limits before recording construction video recordings.
 2. Show existing conditions adjacent to Project site before starting the Work.
 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of demolition.
 4. Show protection efforts by Contractor.

1.7 CONSTRUCTION WEBCAM

- A. Webcam: Provide one fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Architect, with the following characteristics:
 1. Static view.
 2. Capable of producing minimum 12 megapixel images.
 3. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Live Streaming Images: Provide web-accessible image of current site image, updated at 15-minute intervals during daytime operation.
- C. Web-Based Interface: Provide online interface to allow viewing of each high-definition digital still image captured and stored during construction, from the Internet.
 1. Access Control: Provide password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
 2. Storage: Maintain images on the website for reference during entire construction period, and for not less than 30 days after final completion. Provide sufficient memory on remote server to store all Project images.
 3. Online Interface: Provide website interface with Project and client information and logos; calendar-based navigation interface for selecting images; pan and zoom capability within high-definition images.
 4. Forward and Reverse: Provide capability to browse through images, moving forward and backward in time by individual image and by day.
 5. Slideshow: Provide capability to automatically display current images from sites when there are three or more cameras used.
 6. Time-Lapse: Provide capability for online display of project time-lapse.
 7. Dashboard: Provide capability to view thumbnails of all cameras on one screen.
 8. Weather: Provide corresponding weather data for each image captured.
- D. Maintain cameras and web-based access in good working order according to web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

EDR Project No. 22071
December 18, 2025

Odenheimer Building
Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.
- B. Related Requirements:
 - 1. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 2. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 01 3233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
 - 4. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 5. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 6. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 8. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 9. Section 01 8113 "Sustainable Design Requirements" for sustainable design submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name and address of Architect.
 - 4. Name of Contractor.
 - 5. Name of firm or entity that prepared submittal.
 - 6. Names of subcontractor, manufacturer, and supplier.
 - 7. Category and type of submittal.
 - 8. Submittal purpose and description.
 - 9. Specification Section number and title.
 - 10. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 11. Drawing number and detail references, as appropriate.
 - 12. Location(s) where product is to be installed, as appropriate.
 - 13. Related physical samples submitted directly.
 - 14. Indication of full or partial submittal.
 - 15. Transmittal number, numbered consecutively.
 - 16. Submittal and transmittal distribution record.
 - 17. Other necessary identification.
 - 18. Remarks.

19. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 6. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

7. Extended Review: Where individual submittals exceed twenty (20) sheets, the Architect will establish a reasonable additional period beyond the time limits established above or alternatively, the submittal can be split in a manner that expedites the construction sequence.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.

- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
 - 6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.

- e. Description of product.
- f. Test procedures and results.
- g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SUBMITTAL COVER SHEET

SUBMITTAL NUMBER: _____ DATE TO CONSTRUCTOR: _____
DATE TO ARCHITECT: _____

Section Title: _____ Description: _____
Section No.: _____ Page: _____ Article/Paragraph: _____
Detail No. _____ Sheet No. _____

Sub-contractor name: _____ Vendor Name: _____
Address.: _____ Address: _____
Phone Number _____ Phone Number: _____

Attachments:
Product Data Warranties Drawings MSDS Samples
Schedules Reports Calculations Tests Sustainability Criteria
Third Party Certifications

PRODUCT INFORMATION: Attach complete documentation

Product Description / Name: _____
Specified Manufacturer: _____ Model Number: _____
Submitted Manufacturer: _____ Model Number: _____
(company name & address) _____

Contact name: _____ Phone Number: _____

Deviation from Contract Documents? ☐ NO Deviations ☐ YES (attach complete documentation)
LEED Data Sheet required? ☐ Not required ☐ YES (attach complete documentation)
LEED Data Sheet submitted? ☐ Not required ☐ YES (attach complete documentation)

Lead Time (in weeks) after Approval: _____

Date (yyyy-mm-dd) Items Required at Project Site: _____

Sub-contractor **subcontractor coordination** is required with work in these divisions

☐ 02 ☐ 03 ☐ 04 ☐ 05 ☐ 06 ☐ 07 ☐ 08 ☐ 09 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14
☐ 21 ☐ 22 ☐ 23 ☐ 25 ☐ 26 ☐ 27 ☐ 28 ☐ 31 ☐ 32 ☐ 33 (Constructor mark all
that apply)

Constructor Review Stamp: Constructor is responsible for providing submittals which are approvable.

As an authorized agent of the Constructor, I hereby certify that the attached submittal has been reviewed
and as revisions marked, is in complete compliance with the Contract Documents.

Reviewer Signature _____
Printed Name _____ Date: _____
Signed: _____

Architect's Review Stamp: Completed by Architect.

Architect's Consultant Review Stamp

Reviewed for General Conformance with the design concept of the work. Corrections and comments made
or not made on this submittal do not relieve the contractor from compliance with the Contract Documents.
Refer to the Contract Documents for Contractor's Responsibilities.

- ☐ Approved as Submitted
- ☐ Approved, except as noted.
- ☐ No action required.
- ☐ Approved, except as noted, Resubmission required.
- ☐ No action required. Resubmission required.
- ☐ Disapproved. Resubmission required.

Comments: _____

Reviewer _____ Date: _____

END OF FORM –

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:

- a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
 4. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
 - a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
 - E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
 - F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - G. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
 - I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
 - J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.4 DELEGATED-DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
 - B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- C. The contract sum or time will not be increased or extended, respectively, for adverse impacts to the work due to the contractor proceeding with conflicting quality or quantity levels without first notifying the Architect.

1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- E. Reports: Prepare and submit certified written reports and documents as specified.
- F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for

installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - 5. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 - 6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Special Inspector: Special Inspectors shall meet the more stringent of the qualifications listed in this section and the requirements listed in the Statement of Special Inspections submitted to the Authority Having Jurisdiction on this site or otherwise required by the Authority Having Jurisdiction.
- L. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.

5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 10. Demolish and remove mockups when directed unless otherwise indicated.
- M. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings and as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
1. Provide mock-up:
 - a. Where new addition meets existing building.
 - b. New addition plaster wall to standing seam roof condition.
 2. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - a. Include metal studs, sheathing, and air barrier.
 - b. Include veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall portion of mockup.
 3. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
 - 1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 - 2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
- J. Building Envelope: It is the intent of the Construction Documents that the Project be constructed free of water infiltration, excessive air infiltration, excessive moisture or relative humidity build-up in building materials, and that continuous thermal barriers against excessive heat loss or gain are maintained. The proper use of specified materials is essential to ensure this performance. It is the responsibility of the Contractor to review the Documents carefully and advise the Architect of any concerns or recommendations in regard to potential problem areas. It is also the responsibility of the Contractor, during construction, to coordinate the work to ensure that the integrity of the continuous waterproofing and thermal envelope be maintained.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 01 40 00 – QUALITY REQUIREMENTS - EXHIBITS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes procedural and administrative requirements for quality assurance and control.
- B. Products furnished but not installed under this section: None
- C. Products installed but not furnished under this section: None
- D. Related Sections:
 - The Contract Forms, Conditions of this Contract,
 - 01 00 00 – General Requirements
 - 02 00 00 – Existing Conditions

A.02 CODES, REGULATIONS, AUTHORITIES

- A. Comply with all applicable codes, ordinances, regulations and requirements of all authorities having jurisdiction.
- B. Submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgements, and communications from authorities having jurisdiction.

1.03 INDUSTRY STANDARDS

- A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these specifications.
- B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the Exhibit Fabricator/Owner Agreement.
- C. Obtain copies of industry standards directly from publisher.
- D. The titles of industry standard organizations are commonly abbreviated; full titles may be found in *Encyclopedia of Associations* or consult Designer.
- E. Where workmanship is governed by a referenced standard, submit one copy to Designer and additional copies to fabricators, installers, and others involved in the performance of the work.

1.04 INSPECTION OF FABRICATED WORK

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- A. Prior to delivery of fabricated items to the site, complete work shall be inspected by the Designer/Owner at the place of fabrication.
- B. The Exhibit Fabricator shall notify the Designer when and where such work will be available for inspection. Fabricated work shall not be delivered to the site until approved by the Designer at the place of fabrication or authorization to deliver such work to the site is granted for subsequent inspection at the site.

1.05 APPROVAL OF COMPONENTS

- A. Where components are indicated to be provided by the Exhibit Fabricator but are not mentioned by manufacturer's product name or model number, the construction of all such items shall be subject to approval by the Designer and shall conform to approved corresponding submittals, samples, rough mock-ups, prototypes and/or 1st Articles. The Designer may submit additional drawings to the Exhibit Fabricator for elaboration, clarification or revision of such items at the discretion of the Designer. The Exhibit Fabricator's work shall conform to such additional drawings without additional cost to the Contract.

1.06 SPECIFICATION INFORMATION

- A. These specifications are a special form of technical writing edited from master specifications and contain deviations from traditional writing formats. Capitalization, underlining and bold print is only used to assist reader in finding information and no other meaning will be implied.
- B. Except where specifically indicated otherwise, the subject of all imperative statements is the Exhibit Fabricator.
- C. Sections are generally numbered in conformance with Construction Specifications Institute Master Format System. Numbering sequence is not consecutive. Refer to Index of Specification Sections for names and numbers of sections included in this Project.
- D. Pages are numbered separately for each section. Each section is noted with "End of Section" to indicate when section is complete.

1.07 DEFINITIONS

- A. Provide: means furnish and install, complete with all necessary components and accessories, ready for intended use.
- B. Indicated: is a reference to other portions of the Contract Documents.
- C. Approved: Except where specifically stated otherwise, the words "approved", "directed", "requested", "selected", "accepted" mean "approved by the Designer", "directed by the Designer" and so on. The words "approved" and "accepted" shall be held to the limitations stated in the

SECTION 01 40 00 – QUALITY REQUIREMENTS - EXHIBITS

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General and Supplementary Conditions. In no case shall "approval" or "acceptance" by the Designer be interpreted as a release of Exhibit Fabricator of his responsibilities to fulfill all of the requirements of the Contract Documents.

- D. Observe, Observation: Except as otherwise defined in greater detail, the Designer's observation of the work will be held to the limitations stated in the General and Supplementary Conditions and the Owner/Designer agreement. In no case shall observation by the Designer be interpreted as a release of Exhibit Fabricator of his responsibilities to fulfill all of the requirements of the Contract Documents. Observe shall be defined in accordance with the General Conditions of the Contract to include only visiting the site periodically, observing the condition and progress of the work, and reporting to the Owner.
- E. Furnish: Except as otherwise defined in greater detail, furnish means supply, including shop fabrication if applicable, and deliver to project site, ready for unloading, unpacking, assembly, installation and the like as applicable in each instance.
- F. Install: Except as otherwise defined in greater detail, install means operations at project site including, but not limited to, unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, placing in service and similar operations as applicable in each instance.
- G. Installer: The person or firm engaged by Exhibit Fabricator or Subcontractor for performance of a specific unit of installation work at the project site. It is a general requirement that Installers be expert and experienced in the work they are engaged to perform.
- H. Day: Except as otherwise defined in Exhibit Fabricator/Owner Agreement, day means calendar day.

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; (See FGIA).
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 12. AGA - American Gas Association; www.aga.org.
 - 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 16. AIA - American Institute of Architects (The); www.aia.org.
 - 17. AISC - American Institute of Steel Construction; www.aisc.org.
 - 18. AISI - American Iron and Steel Institute; www.steel.org.
 - 19. AITC - American Institute of Timber Construction; www.plib.org.
 - 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 21. ANSI - American National Standards Institute; www.ansi.org.
 - 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 24. APA - Architectural Precast Association; www.archprecast.org.
 - 25. API - American Petroleum Institute; www.api.org.
 - 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 27. ARI - American Refrigeration Institute; (See AHRI).
 - 28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 - 29. ASCE - American Society of Civil Engineers; www.asce.org.

30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.avixa.org.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; www.ec.europa.eu/growth/single-market/ce-marking.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Cast Stone Institute; www.caststone.org.
66. CSI - Construction Specifications Institute (The); www.csiresources.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTA - Consumer Technology Association; www.cta.tech.
69. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
70. CWC - Composite Wood Council; (See CPA).
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECA - Electronic Components Association; (See ECIA).
75. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
76. ECIA - Electronic Components Industry Association; www.ecianow.org.

77. EIA - Electronic Industries Alliance; (See TIA).
78. EIMA - EIFS Industry Members Association; www.eima.com.
79. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
80. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
81. ESTA - Entertainment Services and Technology Association; (See PLASA).
82. ETL - Intertek (See Intertek); www.intertek.com.
83. EVO - Efficiency Valuation Organization; www.evo-world.org.
84. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
85. FGIA - Fenestration and Glazing Industry Alliance; <https://fgiaonline.org>.
86. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
87. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
88. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
89. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
90. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridarooft.com.
91. FSA - Fluid Sealing Association; www.fluidsealing.com.
92. FSC - Forest Stewardship Council U.S.; www.fscus.org.
93. GA - Gypsum Association; www.gypsum.org.
94. GANA - Glass Association of North America; (See NGA).
95. GS - Green Seal; www.greenseal.org.
96. HI - Hydraulic Institute; www.pumps.org.
97. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
98. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
99. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
100. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
101. IAS - International Accreditation Service; www.iasonline.org.
102. ICBO - International Conference of Building Officials; (See ICC).
103. ICC - International Code Council; www.iccsafe.org.
104. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
105. ICPA - International Cast Polymer Association; www.theicpa.com.
106. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
107. IEC - International Electrotechnical Commission; www.iec.ch.
108. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
109. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
110. IESNA - Illuminating Engineering Society of North America; (See IES).
111. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
112. IGMA - Insulating Glass Manufacturers Alliance; (See FGIA).
113. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
114. II - Infocomm International; (See AVIXA).
115. ILI - Indiana Limestone Institute of America, Inc.; www.ili.ai.
116. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
117. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
118. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
119. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
120. ISO - International Organization for Standardization; www.iso.org.
121. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
122. ITU - International Telecommunication Union; www.itu.int.
123. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
124. LMA - Laminating Materials Association; (See CPA).
125. LPI - Lightning Protection Institute; www.lightning.org.
126. MBMA - Metal Building Manufacturers Association; www.mbma.com.

127. MCA - Metal Construction Association; www.metalconstruction.org.
128. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
129. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
130. MHI - Material Handling Industry; www.mhi.org.
131. MIA - Marble Institute of America; (See NSI).
132. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
133. MPI - Master Painters Institute; www.paintinfo.com.
134. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
135. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
136. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
137. NADCA - National Air Duct Cleaners Association; www.nadca.com.
138. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
139. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
140. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
141. NBI - New Buildings Institute; www.newbuildings.org.
142. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
143. NCMA - National Concrete Masonry Association; www.ncma.org.
144. NEBB - National Environmental Balancing Bureau; www.nebb.org.
145. NECA - National Electrical Contractors Association; www.necanet.org.
146. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
147. NEMA - National Electrical Manufacturers Association; www.nema.org.
148. NETA - InterNational Electrical Testing Association; www.netaworld.org.
149. NFHS - National Federation of State High School Associations; www.nfhs.org.
150. NFPA - National Fire Protection Association; www.nfpa.org.
151. NFPA - NFPA International; (See NFPA).
152. NFRC - National Fenestration Rating Council; www.nfrc.org.
153. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
154. NHLA - National Hardwood Lumber Association; www.nhla.com.
155. NLGA - National Lumber Grades Authority; www.nlga.org.
156. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
157. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
158. NRCA - National Roofing Contractors Association; www.nrca.net.
159. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
160. NSF - NSF International; www.nsf.org.
161. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
162. NSPE - National Society of Professional Engineers; www.nspe.org.
163. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
164. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
165. NWFA - National Wood Flooring Association; www.nwfa.org.
166. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
167. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
168. PDI - Plumbing & Drainage Institute; www.pdionline.org.
169. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
170. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
171. RFCI - Resilient Floor Covering Institute; www.rfci.com.
172. RIS - Redwood Inspection Service; www.redwoodinspection.com.
173. SAE - SAE International; www.sae.org.
174. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
175. SDI - Steel Deck Institute; www.sdi.org.
176. SDI - Steel Door Institute; www.steeldoor.org.

177. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
 178. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
 179. SIA - Security Industry Association; www.siaonline.org.
 180. SJI - Steel Joist Institute; www.steeljoist.org.
 181. SMA - Screen Manufacturers Association; www.smainfo.org.
 182. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
 183. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
 184. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
 185. SPIB - Southern Pine Inspection Bureau; www.spib.org.
 186. SPRI - Single Ply Roofing Industry; www.spri.org.
 187. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
 188. SSINA - Specialty Steel Industry of North America; www.ssina.com.
 189. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
 190. STI - Steel Tank Institute; www.steeltank.com.
 191. SWI - Steel Window Institute; www.steelwindows.com.
 192. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
 193. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
 194. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
 195. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 196. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
 197. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 198. TMS - The Masonry Society; www.masonrysociety.org.
 199. TPI - Truss Plate Institute; www.tpinst.org.
 200. TPI - Turfgrass Producers International; www.turfgrassod.org.
 201. TRI - Tile Roofing Institute; www.tilerroofing.org.
 202. UL - Underwriters Laboratories Inc.; www.ul.com.
 203. UL LLC - UL LLC; www.ul.com.
 204. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 205. USAV - USA Volleyball; www.usavolleyball.org.
 206. USGBC - U.S. Green Building Council; www.usgbc.org.
 207. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 208. WA - Wallcoverings Association; www.wallcoverings.org.
 209. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 210. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 211. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 212. WI - Woodwork Institute; www.wicnet.org.
 213. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 214. WWPA - Western Wood Products Association; www.wwpa.org.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the

following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.

2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas Forest Service; Forest Resource Development and Sustainable Forestry; <http://txforestservation.tamu.edu>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 4339

MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Integrated exterior mockups.
- B. Related Requirements:
 - 1. Section 01 4000 "Quality Requirements" for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.

1.2 DEFINITIONS

- A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements and mock-ups serving as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.
- B. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 - 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
 - 2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
 - 3. Review locations and extent of mockups.
 - 4. Review testing procedures to be performed on mockups.
 - 5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups.
 - 1. Include plans, elevations, sections, and mounting attachment and support details.
 - 2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.

3. Include site location drawing indicating orientation of mockup.
4. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

- B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

1.6 QUALITY ASSURANCE

- A. Build mockups to do the following:
1. Verify selections made under Sample submittals.
 2. Demonstrate aesthetic effects.
 3. Demonstrate the qualities of products and workmanship.
 4. Demonstrate acceptable coordination between components and systems.
 5. Perform preconstruction testing, such as window air- and water-leakage testing.
- B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.
- C. Notifications:
1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
 2. Notify Architect 14 days in advance of the dates and times when mockups will be tested.
 3. Allow seven days for initial review and each re-review of each mockup.
- D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 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 COORDINATION

- A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design support structure for free-standing mockups.
- B. Structural Performance:
 - 1. Wind Loads: As indicated on Drawings.

2.2 INTEGRATED EXTERIOR MOCKUPS

- A. Construct integrated exterior mockups as indicated on Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.
- C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.
- D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.
- E. The Work of integrated exterior mockups includes, but is not limited to, the following:
 - 1. Cladding.
 - 2. Windows.
 - 3. Cold-formed metal framing and sheathing.
 - 4. Air and weather barriers.
 - 5. Thermal insulation.
 - 6. Through-wall flashing.
 - 7. Flashing and sheet metal trim.
 - 8. Joint sealants.
- F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 01 3233 "Photographic Documentation." Provide photographs showing details of interface of different materials and assemblies.
- G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.
- H. Retain approved mockups constructed in place. Incorporate fully into the Work.

2.3 MOCKUPS

- A. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the CM's GMP. Allow other entities to use temporary services and facilities without cost, including, but not limited to Design Professional, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Erosion and Sedimentation Control Plan: Show compliance with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- E. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- F. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 3. Indicate methods to be used to avoid trapping water in finished work.
- G. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste-handling procedures.
 5. Other dust-control measures.
- H. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:
1. Methods used to meet the goals and requirements of Owner.
 2. Concrete cutting method(s) to be used.
 3. Location of construction devices on the site.
 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.
- 1.4 QUALITY ASSURANCE
- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- 1.5 PROJECT CONDITIONS
- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- PART 2 - PRODUCTS
- 2.1 MATERIALS
- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.

- B. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- E. Floor Protection Paper: Heavy duty, durable, non-staining paper for floor protection.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Electronic Communication Service:
 - 1. Provide Internet Service: Broadband modem, router and ISP, equipped with hardware firewall at each computer.
 - 2. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille

in system and remove at end of construction and clean HVAC system as required in Section 01 7700 "Closeout Procedures."

- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 01 1000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.
- C. Water Service:
 - 1. Install water service and distribution piping in sizes and pressures adequate for construction.

2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Electric Power Service:
 1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
 2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Connect temporary service to Owner's existing power source, as directed by Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.
 1. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 31 2000 "Earth Moving."
 - 3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 32 1216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- F. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Elevator Use: See Division 14 elevator Section for temporary use of new elevators.
- L. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

- M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- N. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.
- O. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 01 1000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction, and as indicated in Section 01 56 39 -Landscape Protection During Construction.

- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION

SECTION 01 56 39
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary site fencing.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 ACTION SUBMITTALS

- A. Meeting Summary: From Preinstallation Conference.
- B. Product Data: For each type of product indicated.
- C. Samples for verification:
 - 1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.

- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reason for pruning.
 - 4. Description of pruning to be performed.
 - 5. Description of maintenance following pruning.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.6 FIELD CONDITIONS

- A. The health of the existing trees to remain within and just beyond the project boundary is of significant importance to the Owner and the success of this project. No work shall be performed within the Tree Protection Zone, dripline of existing trees, or the area immediately beyond the dripline, to remain unless specifically identified on the drawings and Owner notified prior to commencing work. The Contractor shall perform construction operations with utmost care when in proximity of existing trees. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Moving or parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.
- D. In the event that any operation is likely to damage branches, roots or trunk of any tree to be protected, notify the Owner's Representative in writing seven days in advance of commencing that operation. Work should be done in accordance with the drawings or otherwise directed by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, previous, and black or a darker shade of brown, gray or red than underlying subsoil; reasonably free of subsoil, clay, lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded hardwood mulch as indicated on drawings.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements: Previously used materials may be used when approved by Architect.
 - 1. Chainlink Construction Fence: 6 foot tall fence in locations approved by Owner in the field.
 - 2. Tree Protection-Zone Fencing: Fencing as shown on drawings. Locate as shown on drawings and approved by Owner in the field.
 - 3. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - 1. Size and Text: 24" x 24", sign text: "Tree Protection Zone", letter color to contrast background color.
- E. Wood Mulch: Shredded hardwood bark $\frac{3}{4}$ inch to 1 $\frac{1}{2}$ inch diameter.
- F. Filter Fabric: Mirafi 140N, non-woven drainage fabric, as manufactured by TC Mirafi, or similar, Pendergrass, Georgia, (888) 795-0808 or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch orange vinyl tape around each tree trunk at 54 inches above the ground. Identify discrepancies between site conditions and Contract Documents and forward to Owner's Representative. Obtain Owner's Representative written approval before demolition.
- B. Identify and protect adjacent trees outside of project boundary requiring protection as indicated on drawings and directed by Owner in the field.
- C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- D. Tree-Protection Zones: Mulch areas inside tree-protection zones only as directed by Owner.

3.3 TREE AND PLANT PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Construction Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect and Arborist.
- E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.
3. Construction Fence that must be temporarily moved to allow for work within protection area shall be fully coordinated with the Owner prior to moving. Contractor shall mark original location of fence on ground with spray paint to insure proper re-location. Construction Fence must be reinstalled in exact location immediately upon completion of the work or at the end of the day, whichever comes first.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 00 00 "Earth Work" unless otherwise indicated.
- B. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as approved by Owner and as directed by Arborist.
 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 31 00 00 "Earth Work."
- B. Root Pruning at Edge of Protection Zone as per Arborist: Prune roots flush with the edge of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone as per Arborist: Clear and excavate by hand to the depth of the required excavation to minimize damage to tree root systems. Use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 1 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.
 - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Remove and replace existing trees as directed by Owner.
 - 2. For trees smaller than 4" in caliper size: Replace with tree of same size and species.
 - 3. For trees larger than 4": Provide one new 4" tree of same size as those being replaced for each tree > 4" or < 12".
 - 4. For trees larger than 12" in diameter: Provide one new tree of 4-inch caliper size for every 8" in caliper being replaced. (Example: Replace 24" tree with three 4" trees).
 - 5. Species of Replacement Trees: Species selected by Architect.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 01 2300 "Alternates" for products selected under an alternate.
 - 3. Section 01 2500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 01 4200 "References" for applicable industry standards for products specified.
 - 5. Section 01 770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- B. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."
- C. Bio-based Materials: A product of plant or animal origin, not including products made by killing the animal. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country.
- D. Biopreferred Products: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials

(including plant, animal, and marine materials), or forestry materials and includes biobased intermediate ingredients or feedstocks.

- E. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, for the emissions testing and requirements of products and materials.
- F. Chain of Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- G. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- H. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- I. Chemicals of Concern: Chemicals that are of special concern due to their potential effects on human health and the environment:
 - 1. persistent bio-accumulative toxic (PBT) chemicals;
 - 2. known or suspected human carcinogens.
- J. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and/or plant material pressed and adhered together.
- K. Construction Waste: EPA defines construction and demolition materials as "debris generated during the construction, renovation and demolition of buildings, roads, and bridges".
- L. Cradle to Cradle (C2C) Product Certification: Standard which assesses and certifies products in five categories, Material Health, Material Reutilization, Renewable Energy and Carbon Management, Water Stewardship, and Social Fairness, as defined by the Cradle to Cradle Products Institute.
- M. Cradle to Gate Assessment: Analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.
- N. Cradle to Grave: Analysis of a product's full life cycle, from resource extraction (cradle) to the disposal phase (grave).
- O. Declare Product Label: All ingredients of 100 parts-per-million or greater disclosed and evaluated against the current version of the Living Building Challenge Red List, as defined by the International Living Future Institute.

- P. Embodied carbon: The carbon footprint of a material. It considers how many greenhouse gases (GHGs) are released throughout the supply chain and is often measured from cradle to (factory) gate, or cradle to site (of use).
- Q. Energy Usage Intensity (EUI): is a relative measure of a building's operational energy use per unit of floor area, which is commonly expressed as either kilo-BTU per square foot per year (kBtu/ft²) or kilowatt-hour per square meter per year (kWh/m²).
- R. Environmental Product Declaration (EPD): An EPD is an independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and then peer-reviewed. EPDs can be either industry wide (Generic) or Product Specific:
 - 1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - 2. An Industry-wide Environmental Product Declaration (EPD) is a product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. The industry-wide Environmental Product Declaration shall conform to ISO 14025 and 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope. Also referred to as a "generic" Environmental Product Declaration.
 - 3. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.
- S. Extended Producer Responsibility (EPR): Products whose manufacturer has established measures to reclaim its products at the end of their useful life and to recycle them into the same product.
 - 1. Producers must recover and recycle the materials for use in new products of the same type.
 - 2. EPR programs as also known as "closed-loop" or "product take-back".
- T. Global Warming Potential: Global warming potential is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.
- U. Greenhouse Gas (GHG) Protocol: establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.
- V. GreenScreen® for Safer Chemicals: A method for comparative chemical hazard assessment and their potential effect on human health and the environment.
- W. Green Stormwater Infrastructure: Infrastructure designed to filter and absorb stormwater where it falls.
- X. Grey Water: Wastewater that has been used for washing, laundering, bathing, or showering.
- Y. Health Product Declaration: A standard format for reporting product content and associated health information for building products and materials.
- Z. Indoor Air Quality (IAQ) Management Plan: Plan developed by the contractor to provide a healthy and safe indoor environment for workers during construction as well as the building's current and eventual occupants. The IAQ Management Plan shall meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association

(SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007 (ANSI/SMACNA 008-2008), Chapter 3.

- AA. Inherently nonemitting sources: Products that are inherently nonemitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
- BB. Inside the Building: Defined as inside the weatherproofing system.
- CC. International Living Future Institute (ILFI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The ILFI is administrator of the Living Building Challenge (LBC) Certification.
- DD. International Well Building Institute (IWBI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The IWBI is administrator of the WELL Building Certification.
- EE. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- FF. Leadership in Energy & Environmental Design (LEED): A green building rating system that provides independent third party verification of a project's sustainability.
- GG. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
 - 1. Definitions that are a part of "LEED v4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- HH. Life Cycle Assessment (LCA): An evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040-2006 and ISO 14044-2006.
- II. Light Reflectance Value: a measure of visible and usable light that is reflected from a surface when illuminated by a light source.
- JJ. Low-Emitting Materials Requirements: As defined in Section 018116 "Low-Emitting Materials Requirements"
- KK. Material Cost: The dollar value of materials being provided to the site, after any contractor markups, inclusive of all transportation and tax fees but excluding equipment and labor costs.
- LL. Material Transparency: refers to the practice by manufacturers of disclosing the environmental and health impacts of products.
- MM. Minimum Efficiency Reporting Value (MERV): Unit of measurement used to report a filter's ability to capture larger particulates between 0.3 and 10 microns (µg).
- NN. Multi-Attribute Standard. Sustainable Certification standard that shows impact reduction in several sustainability categories, often including environmental, health, and social. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential;

stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

- OO. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.
- PP. Net Zero Carbon: refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away.
- QQ. Operational Carbon: as defined by Zero Carbon Standard 1.0, International Living Future Institute, is the Greenhouse Gas emissions associated with the operational energy use of a building. This includes all carbon from energy required to heat and power the building, including but not limited to, lighting, plug loads, heating, cooling, and cooking.
- RR. Operational Waste: The waste generated during the operational phase of a building including paper, metal, plastics, confidential waste, and food.
- SS. Parts per Billion (ppb) or Micrograms per Liter ($\mu\text{g/L}$): Unit of measurement, in this case, utilized to measure pollutant.
- TT. Parts per Million (ppm) or Milligrams per Liter (mg/L): Unit of measurement, in this case, utilized to measure pollutant
- UU. Passive (As Related to MEP): Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.
- VV. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.
- WW. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- XX. Program Operator: An organization that ensures EPDs meet the product category rules (PCRs) for the associated product category. The program operator doesn't do the actual life-cycle assessments. UL Environment is the leading program operator in the United States.
- YY. Rain Water: Precipitation on roof structures.

- ZZ. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
 3. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
 4. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
 5. Recycled content of materials shall be defined in accordance with the International Organization for Standardization document, ISO 14021-1999 – Environmental labels and declarations – self declared environmental claims (Type II environmental labeling). www.iso.org
- AAA. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- BBB. Resource Positive: is defined as the practice of storing more carbon than the company emits, eliminating waste and providing cleaner freshwater than the company uses. Amazon buildings will be designed to be resilient to future climate impacts and be positive contributors to the local environment by including advanced water and waste strategies, leverage green infrastructure for stormwater management, and design and operate exterior environments to enhance local ecosystems.
- CCC. Reused Materials: Reclaimed or salvaged equipment or materials previously used in this or other construction, which extends the lifetime of materials that would be otherwise be discarded.
- DDD. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
1. In every case, indicate the location of final assembly.
 2. For harvested products, indicate location of harvest.
 3. For extracted (i.e. mined) products, indicate location of extraction.
 4. For recovered products, indicate location of recovery.
 5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
 6. Acceptable Evidence:
 - a. Manufacturer's certification.
 - b. Life cycle analysis (LCA) performed by third-party.
- EEE. Stormwater: Rainwater or melted snow that runs off streets, lawns and other sites. When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.
- FFF. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that

does meet the requirements of the specifications. Submit a comparable product request, if applicable.

GGG. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

HHH. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified and labeled by The Forest Stewardship Council as FSC 100%, FSC Mixed, or FSC Recycled.

1. FSC 100%: Label indicating that the wood within the product comes entirely from FSC-certified, well-managed forests.
2. FSC Recycled: Label indicating that the wood or paper in the product comes from reclaimed or re-used material.
3. FSC Mix: Label indicating that the wood within the product is from FSC-certified forests, recycled material, or controlled wood. While not FSC-certified, controlled wood cannot be illegally harvested, harvested in violation of traditional and civil rights, harvested in forests where high conservation values are threatened, harvested in forests being converted to plantations or non-forest use, or harvested in forests where genetically modified trees are planted.

III. United States Green Building Council (USGBC): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The USGBC is administrator of the LEED Green Building Rating Systems.

JJJ. Volatile Organic Compound (VOC): Carbon compounds considered indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and wellbeing of installers and occupants.

KKK. Wet Applied Products: Materials and products installed in wet form that have South Coast Air Quality Management District (SCAQMD) rules relating to VOC associated with them. These include the following:

1. SCAQMD Rule 1113: Architectural Coatings
2. SCAQMD Rule 1168: Adhesive and Sealant Applications

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

- a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.
 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 BASIC PRODUCT REQUIREMENTS

- A. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
 1. No available domestic product complies with the Contract Documents.
 2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.
- B. Where possible utilize materials harvested and manufactured regionally, within a 500-mile radius of the project site.

2.2 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ..."
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ..."
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ..."
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

- E. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation for intended use and effect.
- F. Products, which, by nature of their application, are likely to be needed at a later date for maintenance and repair or replacement work, shall be current models for which replacement parts are available.
- G. Product selection shall be done in accordance with the following requirements:
 - 1. Standards, Codes and Regulations: Select from among products that are in compliance with the project requirements, as well as with construction standards, all applicable codes and regulations and sustainable design requirements.
 - 2. Performance Requirements: Provide products that comply with specific performances indicated and are recommended by the manufacturer (in published product literature or by individual certification) for the application indicated.
 - 3. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components and complying with specified requirements for mixing, fabricating, curing, finishing, testing and other operations in the manufacturing process.

2.3 GENERAL ENVIRONMENTAL REQUIREMENTS FOR PRODUCTS

- A. Product selection shall be done in accordance with the following requirements:
 - 1. Comply with Section 01 8116 "Low-Emitting Materials Restrictions."
 - 2. Avoidance of toxic materials: The Contractor will commit to not using the following toxic and hazardous materials:
 - a. Hazardous materials: Defined as pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) or regulated under OSHA Hazard Communication Standard, 29 CFR 1910.1200.
 - b. Harmful materials: Defined as materials which contain the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
 - c. Asbestos: No products containing asbestos.
 - d. Lead:
 - 1) Products containing lead content, including solder or flux containing not more than 0.25 percent lead in wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures, and 0.20% for solder or flux used in plumbing for water intended for human consumption.
 - 2) Not more than 100 ppm (by weight) added lead in all other building materials.
 - e. Mercury:
 - 1) No new mercury containing thermometers, switches and electrical relays.
 - 2) All lamps compliant with the low-mercury limits
 - 3) Illuminated exit signs only use Light-Emitting Diode (LED) or Light-Emitting Capacitor (LEC) lamps.
 - 4) No mercury vapor or probe-start metal halide high intensity discharge lamps.
 - f. Toxicity of prefabricated wood products (composite wood and agrifiber products): Products shall contain no added urea-formaldehyde resins.
 - 1) Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
 - g. Sealants: Provide products that comply with specified VOC limits. Refer to Section 07 9200 – JOINT SEALANTS for additional requirements.

- 1) Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
 - 2) Avoid the use of the following products: Butyl Rubber; Solvent Acrylic; Neoprene; Styrene Butadiene Rubber; Nitril.
 3. Toxic Material Reduction: The Contractor will commit to avoiding the use of following toxic materials:
 - a. Halogenated flame retardants: Limit to 100ppm in the following categories to the extent allowable by local code:
 - 1) Window and waterproofing membranes, door and window frames and siding.
 - 2) Flooring, ceiling tiles and wall coverings.
 - 3) Piping and electrical cables, conduits and junction boxes.
 - b. Phthalate (Plasticizers) Limitation: DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride PVC) are limited in the following components to 0.01% (100 ppm):
 - 1) Flooring, including resilient and hard surface flooring and carpet.
 - 2) Wall coverings, window blinds and shades, shower curtains, furniture and upholstery.
 - 3) Plumbing pipes and moisture barriers.
 - c. Isocyanate-Based Polyurethane Limitation: Isocyanate-based polyurethane products are not used in:
 - 1) Interior finishes.
 - d. Urea-Formaldehyde Restriction: Urea-formaldehyde presence is limited in the following components to 100 ppm:
 - 1) Furniture or any composite wood products.
 - 2) Laminating adhesives and resins.
 - 3) Thermal insulation.
- B. Declaration documentation:
 1. Environmental product declarations - Maximize the permanently installed products which meet one of the disclosure criteria below:
 - a. Product-specific Type III EPD -- Products with EPDs which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope, third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.
 - b. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs, which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
 2. Sourcing of Raw Materials - Maximize the permanently installed products which meet one of the disclosure criteria below:
 - a. Bio-based materials. Bio-based products shall meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material.
 - b. New wood products. Wood products shall be certified by the Forest Stewardship Council or USGBC-approved equivalent.
 - c. Materials reuse. Reuse includes salvaged, refurbished, or reused products.
 - d. Recycled content. Recycled content is the sum of postconsumer recycled content plus one-half the pre-consumer recycled content, based on cost.

- e. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
- f. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- 3. Material ingredient reporting - Maximize the permanently installed products which meet one of the disclosure criteria below. Compliant products shall have chemicals inventoried to at least 0.1% (1000 ppm).
 - a. Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:
 - 1) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN) and/or European Community Number (EC Number).
 - 2) Materials defined as trade secret or intellectual property may withhold the name and/or CASRN/EC Number but must disclose ingredient/chemical role, amount and hazard score/class using either:
 - a) Greenscreen List Translator (LT) score and/or Full GreenScreen Benchmark (BM) or the Globally Harmonized System of Classification and Labeling of Chemicals rev.6 (2015) (GHS)
 - b) The hazard screen must be applied to each trade secret ingredient and the inventory lists the hazard category for each of the health hazards included in Part 3 of GHS (e.g. "GHS Category 2 Carcinogen").
 - b. Health Product Declaration. The end use product has a published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
 - c. Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.
 - d. Declare. The Declare product label must meet the following requirements:
 - 1) Declare labels designated as Red List Free or Declared.
 - 2) Declare labels designated as Red List Approved that demonstrate content inventory to 0.1% (1000 ppm).
 - e. ANSI/BIFMA e3 Furniture Sustainability Standard. The documentation from the assessor or scorecard from BIFMA must demonstrate the product earned at least 3 points under 7.5.1.3 Advanced Level in e3-2014 or 3 points under 7.4.1.3 Advanced Level in e3-2012.
 - f. UL Product Lens Certification.
 - g. Facts – NSF/ANSI 336 Sustainability Assessment for Commercial Furnishings Fabric

2.4 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 71 17

ANIMAL MANAGEMENT REQUIREMENTS OF CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Animal Management requirements of construction are indicated at various areas of the Construction Documents. These requirements are general in nature and indicate universal type details required to be constructed as part of the Base Contract Price for this Project. Inclusive of these requirements, the contractor and all sub-contractors shall, as part of the Base Contract Price, do the following:
 - 1. Animals have been known to injure themselves due to items left in exhibit spaces. Each contractor is responsible for regularly removing all construction debris in compliance with this requirement for work in his/her area including, but not limited to nails, screws, wire, wood & metal scraps, welding rods, and other small fasteners or miscellaneous items.
 - 2. Provide the special animal management requirements of construction wherever required as shown in the drawings or written into these Specifications.
- B. The intent of these requirements is to ensure that the Owner obtains a facility in which zoo personnel and animals may interact safely for the betterment of the entire exhibit. These requirements are not intended to cover all conditions that may arise during construction and the Contractor shall cooperate with the Owner and Architect during construction.
- C. The Contractor shall recognize that this facility is of unique construction and shall at all times take precautions to minimize the use of the Animal Management requirements as much as possible by thorough coordination of all the sub-trades involved, and thorough coordination of placement of all Work prior to installation throughout the Project, to minimize contact with the animals.

END OF SECTION 01 71 17

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for coordination of Owner-furnished products, and limits on use of Project site.
 - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 4. Section 02 4119 "Selective Demolition" for demolition and removal of selected portions of the building.
 - 5. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting

- and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
- 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in

increased maintenance or decreased operational life or safety. Operational elements include the following:

- a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.
- K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
 2. Refer to Section 01 1000 "Summary" for other requirements for Owner-furnished, Contractor-installed products
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "General Commissioning Requirements."

- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 02 4119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 2. Section 04 2000 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction 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.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste by weight or volume.
 - 4. Quantity of waste salvaged, both estimated and actual by weight or volume.
 - 5. Quantity of waste recycled, both estimated and actual by weight or volume.
 - 6. Total quantity of waste recovered (salvaged plus recycled) by weight or volume.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- H. 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.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste or other approved form. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
1. Demolition Waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.
 - f. Wood studs.
 - g. Wood joists.
 - h. Plywood and oriented strand board.
 - i. Wood paneling.
 - j. Wood trim.
 - k. Structural and miscellaneous steel.
 - l. Rough hardware.
 - m. Roofing.
 - n. Insulation.
 - o. Doors and frames.
 - p. Door hardware.
 - q. Windows.
 - r. Glazing.
 - s. Metal studs.
 - t. Gypsum board.
 - u. Acoustical tile and panels.
 - v. Carpet.
 - w. Carpet pad.
 - x. Demountable partitions.
 - y. Equipment.
 - z. Cabinets.
 - aa. Plumbing fixtures.
 - bb. Piping.
 - cc. Supports and hangers.
 - dd. Valves.
 - ee. Sprinklers.
 - ff. Mechanical equipment.
 - gg. Refrigerants.
 - hh. Electrical conduit.
 - ii. Copper wiring.
 - jj. Lighting fixtures.
 - kk. Lamps.
 - ll. Ballasts.
 - mm. Electrical devices.
 - nn. Switchgear and panelboards.
 - oo. Transformers.
 2. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.

- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.
- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 01 5000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- C. Salvaged Items for Sale and Donation: Not permitted on Project site.
- D. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- G. Plumbing Fixtures: Separate by type and size.
- H. Lighting Fixtures: Separate lamps by type and protect from breakage.
- I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 4-inch size.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 4-inch size.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Conduit: Reduce conduit to straight lengths and store by type and size.
- N. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
- D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.

- E. Form CWM-7 for construction waste
- F. Form CWM-8 for demolition waste.

END OF SECTION

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 01 3233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 01 7900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 2900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit final completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.

- d. Name of Contractor.
- e. Page number.
- 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.
 - b. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Architect.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

- b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 7300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 9113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

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Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for final property survey.
 - 2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit record digital data files and one set of plots.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit Record Digital Data Files and three set(s) of Record Digital Data File plots.
 - 2) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.

- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
- B. Format: Submit record Specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
- C. Format: Submit record Product Data as annotated PDF electronic file.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator and instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name of Architect.
 - c. Name of Contractor.
 - d. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to

corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 7823 "Operation and Maintenance Data."Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

- a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.

- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 8113

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

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

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits, but the project will not be pursuing LEED certification.
 - 1. Specific sustainable requirements are included in greater detail in other Sections.
- B. Related Sections:
 - 1. Section 01 7419 "Construction Waste Management and Disposal".
 - 2. Section 01 8116 Low-Emitting Materials Restrictions
 - 3. Divisions 01 through 33: Sustainable requirements specific to the work of each of these Sections.

1.3 DEFINITIONS

- A. Bio-based Materials: A product of plant or animal origin, not including products made by killing the animal. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country.
- B. Biopreferred Products: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials and includes biobased intermediate ingredients or feedstocks.
- C. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, for the emissions testing and requirements of products and materials.
- D. Chain of Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- E. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- F. Chemicals of Concern: Chemicals that are of special concern due to their potential effects on human health and the environment:

1. persistent bio-accumulative toxic (PBT) chemicals;
 2. known or suspected human carcinogens.
- G. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and/or plant material pressed and adhered together.
- H. Construction Waste: EPA defines construction and demolition materials as “debris generated during the construction, renovation and demolition of buildings, roads, and bridges”.
- I. Cradle to Cradle (C2C) Product Certification: Standard which assesses and certifies products in five categories, Material Health, Material Reutilization, Renewable Energy and Carbon Management, Water Stewardship, and Social Fairness, as defined by the Cradle to Cradle Products Institute.
- J. Cradle to Gate Assessment: Analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.
- K. Cradle to Grave: Analysis of a product's full life cycle, from resource extraction (cradle) to the disposal phase (grave).
- L. Declare Product Label: All ingredients of 100 parts-per-million or greater disclosed and evaluated against the current version of the Living Building Challenge Red List, as defined by the International Living Future Institute.
- M. Embodied carbon: The carbon footprint of a material. It considers how many greenhouse gases (GHGs) are released throughout the supply chain and is often measured from cradle to (factory) gate, or cradle to site (of use).
- N. Energy Usage Intensity (EUI): is a relative measure of a building's operational energy use per unit of floor area, which is commonly expressed as either kilo-BTU per square foot per year (kBtu/ft²) or kilowatt-hour per square meter per year (kWh/m²).
- O. Environmental Product Declaration (EPD): An EPD is an independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and then peer-reviewed. EPDs can be either industry wide (Generic) or Product Specific:
1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 2. An Industry-wide Environmental Product Declaration (EPD) is a product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. The industry-wide Environmental Product Declaration shall conform to ISO 14025 and 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope. Also referred to as a “generic” Environmental Product Declaration.
 3. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.
- P. Extended Producer Responsibility (EPR): Products whose manufacturer has established measures to reclaim its products at the end of their useful life and to recycle them into the same product.

1. Producers must recover and recycle the materials for use in new products of the same type.
 2. EPR programs as also known as "closed-loop" or "product take-back".
- Q. Global Warming Potential: Global warming potential is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.
- R. Greenhouse Gas (GHG) Protocol: establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.
- S. GreenScreen® for Safer Chemicals: A method for comparative chemical hazard assessment and their potential effect on human health and the environment.
- T. Green Stormwater Infrastructure: Infrastructure designed to filter and absorb stormwater where it falls.
- U. Grey Water: Wastewater that has been used for washing, laundering, bathing, or showering.
- V. Health Product Declaration: A standard format for reporting product content and associated health information for building products and materials.
- W. Indoor Air Quality (IAQ) Management Plan: Plan developed by the contractor to provide a healthy and safe indoor environment for workers during construction as well as the building's current and eventual occupants. The IAQ Management Plan shall meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007 (ANSI/SMACNA 008-2008), Chapter 3.
- X. Inherently nonemitting sources: Products that are inherently nonemitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
- Y. Inside the Building: Defined as inside the weatherproofing system.
- Z. International Living Future Institute (ILFI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The ILFI is administrator of the Living Building Challenge (LBC) Certification.
- AA. International Well Building Institute (IWBI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The IWBI is administrator of the WELL Building Certification.
- BB. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- CC. Leadership in Energy & Environmental Design (LEED): A green building rating system that provides independent third party verification of a project's sustainability.

- DD. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
1. Definitions that are a part of "LEED v4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.
- EE. Life Cycle Assessment (LCA): An evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040-2006 and ISO 14044-2006.
- FF. Light Reflectance Value: a measure of visible and usable light that is reflected from a surface when illuminated by a light source.
- GG. Low-Emitting Materials Requirements: As defined in Section 01 8116 "Low-Emitting Materials Requirements"
- HH. Material Cost: The dollar value of materials being provided to the site, after any contractor markups, inclusive of all transportation and tax fees but excluding equipment and labor costs.
- II. Material Transparency: refers to the practice by manufacturers of disclosing the environmental and health impacts of products.
- JJ. Minimum Efficiency Reporting Value (MERV): Unit of measurement used to report a filter's ability to capture larger particulates between 0.3 and 10 microns (μg).
- KK. Multi-Attribute Standard. Sustainable Certification standard that shows impact reduction in several sustainability categories, often including environmental, health, and social. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.
- LL. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.
- MM. Net Zero Carbon: refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away.
- NN. Operational Carbon: as defined by Zero Carbon Standard 1.0, International Living Future Institute, is the Greenhouse Gas emissions associated with the operational energy use of a building. This includes all carbon from energy required to heat and power the building, including but not limited to, lighting, plug loads, heating, cooling, and cooking.
- OO. Operational Waste: The waste generated during the operational phase of a building including paper, metal, plastics, confidential waste, and food.
- PP. Parts per Billion (ppb) or Micrograms per Liter ($\mu\text{g/L}$): Unit of measurement, in this case, utilized to measure pollutant.
- QQ. Parts per Million (ppm) or Milligrams per Liter (mg/L): Unit of measurement, in this case, utilized to measure pollutant
- RR. Passive (As Related to MEP): Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing

fixtures, faucets, showerheads, and lamp housings. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.

- SS. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.
- TT. Program Operator: An organization that ensures EPDs meet the product category rules (PCRs) for the associated product category. The program operator doesn't do the actual life-cycle assessments. UL Environment is the leading program operator in the United States.
- UU. Rain Water: Precipitation on roof structures.
- VV. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
 3. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
 4. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
 5. Recycled content of materials shall be defined in accordance with the International Organization for Standardization document, ISO 14021-1999 – Environmental labels and declarations – self declared environmental claims (Type II environmental labeling). www.iso.org
- WW. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- XX. Resource Positive: is defined as the practice of storing more carbon than the company emits, eliminating waste and providing cleaner freshwater than the company uses. Amazon buildings will be designed to be resilient to future climate impacts and be positive contributors to the local environment by including advanced water and waste strategies, leverage green infrastructure for stormwater management, and design and operate exterior environments to enhance local ecosystems.
- YY. Reused Materials: Reclaimed or salvaged equipment or materials previously used in this or other construction, which extends the lifetime of materials that would be otherwise be discarded.
- ZZ. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
1. In every case, indicate the location of final assembly.
 2. For harvested products, indicate location of harvest.
 3. For extracted (i.e. mined) products, indicate location of extraction.
 4. For recovered products, indicate location of recovery.
 5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
 6. Acceptable Evidence:

- a. Manufacturer's certification.
- b. Life cycle analysis (LCA) performed by third-party.

AAA. Stormwater: Rainwater or melted snow that runs off streets, lawns and other sites. When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.

BBB. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified and labeled by The Forest Stewardship Council as FSC 100%, FSC Mixed, or FSC Recycled.

- 1. FSC 100%: Label indicating that the wood within the product comes entirely from FSC-certified, well-managed forests.
- 2. FSC Recycled: Label indicating that the wood or paper in the product comes from reclaimed or re-used material.
- 3. FSC Mix: Label indicating that the wood within the product is from FSC-certified forests, recycled material, or controlled wood. While not FSC-certified, controlled wood cannot be illegally harvested, harvested in violation of traditional and civil rights, harvested in forests where high conservation values are threatened, harvested in forests being converted to plantations or non-forest use, or harvested in forests where genetically modified trees are planted.

CCC. United States Green Building Council (USGBC): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The USGBC is administrator of the LEED Green Building Rating Systems.

DDD. Volatile Organic Compound (VOC): Carbon compounds considered indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and wellbeing of installers and occupants.

EEE. Wet Applied Products: Materials and products installed in wet form that have South Coast Air Quality Management District (SCAQMD) rules relating to VOC associated with them. These include the following:

- 1. SCAQMD Rule 1113: Architectural Coatings
- 2. SCAQMD Rule 1168: Adhesive and Sealant Applications

1.4 PROJECT GOALS

A. The proposed project is designed to be sustainable, with the intent of incorporating the following qualities:

- 1. The project will minimize its effect on the environment by selecting environmentally friendly building materials and utilizing sustainable construction practices.
- 2. The project will provide a healthy and comfortable space for its occupants by developing and following an Indoor Air Quality Management Plan during construction, by selecting only non-toxic and low-emitting materials, and by designing the building's systems to provide tenants with exceptional indoor air quality.
- 3. The finished project will consume significantly less energy and water than a typical code-compliant building through the use of premium efficiency equipment and designing efficient building systems.
- 4. Detailed requirements for addressing specific chemicals of concern are included in Division 2-32 sections that follow. Beyond these material requirements, contractor is encouraged to avoid chemical flame retardants (unless required by code), antimicrobials, and per- and polyfluoroalkyl substances in other building materials.

1.5 MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Review sustainability requirements and action plans for complying with requirements.

1.6 ACTION SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.
- B. Contractor is responsible for submitting and installing products in accordance with the Sustainable Material Performance requirements outlined as well as:
 - 1. PRODUCT DATA REPORTING FORM Coversheet: Submittal packages shall also include documentation in support of the sustainability claims made on the LEED coversheet, including:
 - a. Cost of each material or product, excluding labor and equipment
 - b. From manufacturer, for each product's environmental attributes. This includes a report describing raw materials suppliers, complete content inventory for the product, and/or environmental product declaration.
 - c. Highlight compliance with all requirements for low-emitting materials as noted in Part 2 (Products).
 - 2. Providing and following an Erosion and Sedimentation Control Plan.
 - 3. Providing and following a Construction Waste Management Plan and ongoing documentation of construction and demolition waste recycling / salvage rates for all categories of waste. See Section 017419 - Construction Waste Management and Disposal.
 - 4. During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008, Chapter
 - 5. Contractor to provide Commissioning Authority with a copy of approved submittals for all equipment to be commissioned as well as documentation requested by the Commissioning Authority which is necessary for the commissioning process. This may include: detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information including all responsibilities of the Owner to keep the warranty in force clearly identified. The actual field checkout sheet forms to be used by the factory or field technicians shall be provided to the Commissioning Authority.

PART 2 - PRODUCTS

2.1 SUSTAINABLE MATERIALS

- A. Environmental product declarations - Maximize the permanently installed concrete, steel, gypsum board and insulation products which meet one of the disclosure criteria below:
 - 1. Product-specific Type III EPD -- Products with EPDs which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope, third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.

2. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs, which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
- B. Sourcing of Raw Materials - Maximize the permanently installed products which meet one of the disclosure criteria below:
1. Bio-based materials. Bio-based products shall meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material.
 2. New wood products. Wood products shall be certified by the Forest Stewardship Council or USGBC-approved equivalent.
 3. Materials reuse. Reuse includes salvaged, refurbished, or reused products.
 4. Recycled content. Recycled content is the sum of postconsumer recycled content plus one-half the pre-consumer recycled content, based on cost.
 5. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 6. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
- C. Material ingredient reporting - Maximize the permanently installed products which meet one of the disclosure criteria below. Compliant products shall have chemicals inventoried to at least 0.1% (1000 ppm).
1. Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:
 - a. A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN) and/or European Community Number (EC Number).
 - b. Materials defined as trade secret or intellectual property may withhold the name and/or CASRN/EC Number but must disclose ingredient/chemical role, amount and hazard score/class using either:
 - 1) Greenscreen List Translator (LT) score and/or Full GreenScreen Benchmark (BM) or the Globally Harmonized System of Classification and Labeling of Chemicals rev.6 (2015) (GHS)
 - 2) The hazard screen must be applied to each trade secret ingredient and the inventory lists the hazard category for each of the health hazards included in Part 3 of GHS (e.g. "GHS Category 2 Carcinogen").
 2. Health Product Declaration. The end use product has a published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.
 3. Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.
 4. Declare. The Declare product label must meet the following requirements:
 - a. Declare labels designated as Red List Free or Declared.
 - b. Declare labels designated as Red List Approved that demonstrate content inventory to 0.1% (1000 ppm).
 5. ANSI/BIFMA e3 Furniture Sustainability Standard. The documentation from the assessor or scorecard from BIFMA must demonstrate the product earned at least 3 points under 7.5.1.3 Advanced Level in e3-2014 or 3 points under 7.4.1.3 Advanced Level in e3-2012.
 6. UL Product Lens Certification.
 7. Facts – NSF/ANSI 336 Sustainability Assessment for Commercial Furnishings Fabric

2.2 LOW-EMITTING MATERIALS

- A. Comply with Section 01 8116 "Low-Emitting Materials Restrictions."

2.3 INDOOR AIR QUALITY

- A. Comply with Section 01 8119 "Construction Indoor Air Quality Management."

PART 3 - EXECUTION

3.1 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

- A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3."
 - 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 5000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - 2. Replace all air filters immediately prior to occupancy.

3.2 NONSMOKING BUILDING

- A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.3 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Section 01 7419 "Construction Waste Management and Disposal."

3.4 COMMISSOINING

- A. Comply with Division 01 Section "General Commissioning Requirements".

3.5 ATTACHMENTS

- A. PRODUCT DATA REPORTING FORM follows this Section and is available in MS Excel format for Contractor's use.

END OF SECTION

PRODUCT DATA REPORTING FORM

THIS FORM IS REQUIRED TO BE SUBMITTED *WITH Product Data Submittals*

You must include backup documentation such as *SPECIFIC* Product Data Sheets, Cut Sheets, Product Specific Letter from Manufacturer, etc. DO NOT INCLUDE GENERIC MARKETING MATERIAL

PROJECT NAME:

SUBCONTRACTOR:

Specification Section:Submittal Number:

Project Product Data					Materials and Resources LEED Credits								Low-Emitting Materials LEED Credits			
					MR EPD		Material Ingredient									
													Some Qualifying VOC Standards (More in Note 10): CDPH Standard Method v1.1 FloorScore: Hard Surfaces & Adhesives Green Label Plus: Carpet, Adhesive, Cushion UL Greengaurd Gold: When Meeting CDPH Std. v1.1			
	Spec Section/ Product	Manufacturer	Product Costs ¹ (only exclude install labor) (\$)	Product Specific (PS) or Industry Wide (IW) Env. Product Declaration (EPD) ² ?	FSC Certified ³ Wood Products? (%)	Manufacturer Inventory ⁸	Fully Declared HPD to 1000 ppm Declaration ⁹ included?	C2C version (2.1.1 or 3.0) Level of Certification ¹⁰	Declare Label ¹¹ with ingredient disclosure greater than 1000 ppm?	Cradle to Cradle Material Health Certificate ¹³	Product Lens ¹⁴		CDPH Emissions ¹⁶ testing compliant?	VOC Content ¹⁷ (g/L)	Wet-Applied Products Volume Used (L)	Composite Products are ULEF or NAUF ¹⁹ ?
Ex.		ABC Product	ABC. Inc.	\$ XX,XXX	PS / IW	%	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	##	##	Yes / No
1																
2																
3																
4																
5																
6																
7																
8																
9																

NOTES / DEFINITIONS:

1. Furnish Costs include all expenses to deliver the material to the project site, including taxes, transport, fabrication and profit. Do not include site labor or installation.
2. Environmental Product Declarations which conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have <https://spot.ulprospector.com/en/na/BuiltEnvironment>
3. Wood products must be certified by the Forest Stewardship Council (FSC) and must be provide proof of vendor FSC Cf <http://info.fsc.org/certificate.php>
4. Post-Consumer Recycled Content: Sourced from recovered Consumer Waste and used as a raw material (e.g. plastic bottles, newspaper, etc).
5. Pre-Consumer Recycled Content: Recovered Industrial Materials diverted from municipal solid waste for use in a different mfg. process, prior to use by a consumer. Note: "home scrap" from the original mfg. process that are reused / reprocessed do not qualify.
6. Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. (e.g. Closed Loop or Take Back Program)
7. Within 100 miles distance is defined as travel by air to the project site, not travel distance by road.
8. The manufacturer has published complete content inventory for the product following LEED v4 Guidelines.
9. The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product <http://www.hpd-collaborative.org/hpd-public-repository/>
10. The end use product has a published Crade to Cradle product certification at the Bronze level or higher and at least 90% of materials are assessed by weight.
11. The end us product has a Declare label indicating all ingredients have been disclosed and screened against the red list down to 1000 ppm.
12. The end us product has documentation from the assessor or scorecard from BIFMA that demonstrates the product earned at least 3 points under 7.5.1.3 Advanced Level in e3-2014 or 3 points under 7.4.1.3 Advanced Level in e3-2012.
13. The end use product has a published Crade to Cradle Material Health certification at the Bronze level or higher and at least 90% of materials are assessed by weight.
14. the end use product has a published Product Lens certification. <https://spot.ulprospector.com/en/na/BuiltEnvironment>
15. The end us product has a Sustainability Assessment for Commercial Furnishings Fabric at any certification level

16. TVOC Emissions for Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) S <http://www.usgbc.org/resources/low-emitting-materials-third-party-certification-table>
17. All paints and coatings wet-applied on site must meet applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 1, 2007.
18. Composite Wood Evaluation as defined by the California Air Resources Board (CARB), Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, must be documented to have low formaldehyde emissions that meet the CARB ATCM for Composite Wood Products.

I, _____ a duly authorized representative of _____ hereby certify that the material information submitted here is an accurate representation of the building materials and products used in the project.

EMAIL CONTACT FOR AUTHORIZED REPRESENTATIVE: _____ Direct Phone: _____

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____ DATE: _____

SECTION 01 8116

LOW-EMITTING MATERIALS RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Requirements for Indoor-Emissions-Restricted products.
 - 2. Requirements for VOC-Content-Restricted products.
 - 3. Certification that non-compliant products are not installed on Project.
- B. Related Sections:
 - 1. Section 01 8113: "Sustainable Design Requirements"

1.2 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Interior thermal and acoustical insulation.
 - 7. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
 - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers; including firestopping sealants and duct joint sealers.
- F. Inherently nonemitting sources: Products that are inherently nonemitting sources of VOCs are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
 - 1. Stone.
 - 2. Concrete.
 - 3. Clay brick.
 - 4. Metals that are plated, anodized, or powder-coated.
 - 5. Glass.
 - 6. Ceramics.
 - 7. Solid wood flooring that is unfinished and untreated.

- G. Composite Wood: Products composed of wood or plant particles or fibers bonded by a synthetic resin or binder; including the following:
1. Particleboard.
 2. Medium-density fiberboard (MDF).
 3. Plywood.
 4. Oriented-strand board (OSB).
 5. Wheatboard.
 6. Strawboard.

1.3 REFERENCE STANDARDS

- A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict of referenced standards and this specification or within the standards themselves, the more stringent standard or requirement shall govern.
1. Rule 1168 - "Adhesive and Sealant Applications", South Coast Air Quality Management District (SCAQMD), State of California <http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1168.pdf>
 2. Rule 1113 - "Architectural Coatings": South Coast Air Quality Management District (SCAQMD), State of California <http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1113.pdf>
 3. Green Seal Paint Standard GS-11, Green Seal, Inc., Washington, DC. http://www.greenseal.org/Portals/0/Documents/Standards/GS-11/GS-11_Ed3-2_Paints_Coatings_Stains_and_Sealers.pdf
 4. Green Seal Commercial Adhesive Standard GS-36, Green Seal, Inc., Washington, DC http://www.greenseal.org/Portals/0/Documents/Standards/GS-36/GS-36Ed2-1_Adhesives_for_Commercial_Use%202018.pdf
 5. California Air Resources Board (CARB) 2007 https://www.arb.ca.gov/coatings/arch/Approved_2007_SCM.pdf
 6. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
 7. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
 8. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association.
 9. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating.
 10. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.
 11. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.
 12. CHPS (HPPD) - High Performance Products Database.
 13. CRI (GLP) - Green Label Plus Testing Program - Certified Products.
 14. SCS (CPD) - SCS Certified Products.
 15. UL (GGG) - GREENGUARD Gold Certified Products.

1.4 SUBMITTALS

- A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- B. Sustainable Design Reporting: Submit evidence of compliance.

- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either (1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.5 QUALITY ASSURANCE

- A. VOC Emissions Evaluation - Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) GREENGUARD Gold certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
 - c. Certification by manufacturer that product complies with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) or EPA TSCA VI for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scs-certified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
 - d. Wood structural panel manufactured according to PS 1-09 or PS 2-10 (or one of the standards considered by CARB to be equivalent to PS 1 or PS 2) and labeled bond classification Exposure 1 or Exterior
 - e. Structural wood product manufactured according to ASTM D 5456 (for structural composite lumber), ANSI A190.1 (for glued laminated timber), ASTM D 5055 (for I-joists), ANSI PRG 320 (for cross-laminated timber), or PS 20-15 (for finger-jointed lumber).
- D. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Ceilings, Walls, and Insulation: Ceilings, walls, and thermal 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."

- F. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC Emissions Evaluation - Product Requirements:
 - 1. Paints and Coatings: CAL (CDPH SM).
 - 2. Adhesives and Sealants: CAL (CDPH SM).
 - 3. Flooring: CAL (CDPH SM).
 - 4. Insulation: CAL (CDPH SM).
 - 5. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - 6. Exceptions: Inherently Non-Emitting Materials are not required to have VOC emissions testing.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Aerosol Adhesives: GreenSeal GS-36.
 - 3. Joint Sealants: SCAQMD 1168 Rule.
 - 4. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.
- D. Chemical Content: Products shall be free of halogenated and organophosphorous flame retardants, per- and polyfluoroalkyl substances (i.e. stain and water repellants), and antimicrobials.
- E. Building products shall be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017, using the applicable exposure scenario. Organizations that certify manufacturers' claims must be accredited under ISO Guide 65. Laboratories that conduct the tests specified in this credit must be accredited under ISO/IEC 17025 for the test methods they use. The manufacturer or third-party's certification shall state the exposure scenario used to determine compliance and shall state the range of total VOCs after 14 days. Claims of compliance for wet-applied products shall state the amount applied in mass per surface area. Statements of product compliance must follow product declaration guidelines in CDPH Standard Method v1.2-2017, Section 8. Manufacturer statements must also include a summary report from the laboratory that is less than three years old.
- F. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) shall be disclosed.
- G. Methylene chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, or sealants.

2.2 INTERIOR ADHESIVES

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, and adhesive primers used on the interior of this Project shall not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.
2. The VOC limits defined by SCAQMD are measured in grams per liter (g/L), less water and less exempt compounds.
3. General: For specified building construction related applications, the allowable VOC content is as follows:
 - a. Architectural Applications:

1) Building Envelope Membrane Adhesive	250
2) Carpet Pad Adhesive	50
3) Ceramic Tile Adhesive	65
4) Cove base adhesive	50
5) Drywall and panel adhesive	50
6) Multipurpose construction adhesive	70
7) Roofing	
a) Single ply roof membrane adhesives	250
b) All other roof adhesives	250
8) Rubber Floor Adhesive	60
9) Structural glazing adhesive	100
10) Structural wood member adhesives	140
11) Subfloor adhesive	50
12) VCT and asphalt tile adhesive	50
13) Wood Flooring Adhesive	100
14) All other indoor floor covering adhesives	50
15) All other outdoor floor covering adhesives	50
 - b. Specialty Applications:

1) Contact Adhesive	80
2) Edge glue adhesive	250
3) All other plastic cement	
a) ABS welding	325
b) ABS to PVC transition cement	510
c) PVC welding	510
d) CPVC welding	490
e) All other plastic welding cements	250
4) Adhesive primer for plastic	550
5) Special Purpose Contact Adhesive	250
6) Adhesive Primer for Traffic Marking Tape	150
7) Structural Wood Member Adhesive	140
8) Top and trim adhesive	250
 - c. Substrate Specific Applications:

1) Metal to metal	30
2) Plastic foams	50
3) Porous material (except wood)	50
4) Wood	30
5) Fiberglass	80
6) Reinforced Plastic Composite	200
 - d. Other

1) Other adhesives	250
2) Adhesive bonding primers	250
3) Adhesive primers, or any other primers	250
 - e. Adhesive Primers:

1)	Plastic	550
2)	Pressure sensitive	785
3)	Traffic marking tape	150
4)	All other adhesive primers	250

2.3 INTERIOR SEALANTS

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, sealant primers and sealants used on the interior of this Project shall not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.
2. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
3. General: For specified building construction related applications, the allowable VOC content is as follows:
 - a. Sealants:

1)	Clear, Paintable, and Immediately Water-Resistant Sealant	250
2)	Foam insulation and sealant	250
3)	Grout Sealant	65
4)	Non-Staining Plumbing Putty	150
5)	Potable Water Sealant	100
6)	Single Ply Roof Membrane Sealants	450
7)	Other Roof Sealants	300
8)	All other Architectural Sealants	50
9)	All other Sealants	420
 - b. Sealant Primer:

1)	Architectural - Nonporous	250
2)	Architectural- Porous	775
3)	Modified Bituminous	500
4)	Other	750

2.4 INTERIOR ARCHITECTURAL PAINTS

A. VOC Limits

1. VOC Content Requirements for Wet Applied Products: All paints and coatings wet-applied on site must meet the applicable VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016. Product specific requirements are as follows:
 - a. Paints

1)	Flat	10
2)	Non-Flat	100
3)	Non-Flat High Gloss Coatings	150
 - b. Coatings:

1)	Aluminum roof coatings	100
2)	Basement specialty coatings	400
3)	Bituminous roof coatings	50
4)	Bituminous roof primers	350
5)	Bond breakers	350
6)	Building envelope coatings	50
7)	Concrete curing compounds	100
8)	Concrete/Masonry Sealers	100

9)	Concrete Surface Retarders	50
10)	Dry fog coatings	50
11)	Faux finishing coatings	
a)	Clear topcoat	100
b)	Decorative coatings	350
c)	Glazes	350
d)	Japan	50
e)	Trowel applied coatings	50
12)	Fire resistive Coatings	150
13)	Floor coatings	50
14)	Form-release compounds	100
15)	Graphic arts coatings (sign paints)	200
16)	High temperature coatings	420
17)	Industrial maintenance coatings	100
a)	Color indicating safety coatings	480
b)	High temperature IM coatings	420
c)	Non-sacrificial anti-graffiti coatings	100
d)	Zinc-rich IM primers	100
18)	Low-Solids Coatings	120
19)	Magnesite cement coatings	450
20)	Mastic texture coatings	100
21)	Metallic pigmented coatings	150
22)	Multi-color coatings	250
23)	Pre-treatment wash primers	420
24)	Primers, Sealers, and Undercoaters	100
25)	Reactive penetrating sealers	350
26)	Recycled coatings	250
27)	Roof Coatings	50
28)	Rust Preventative Coatings	100
29)	Sacrificial Anti-Graffiti Coatings	50
30)	Shellacs	
a)	Clear	730
b)	Opaque	550
31)	Specialty primers, sealers, and undercoaters	50
32)	Stains	250
33)	Stone Consolidants	450
34)	Swimming Pool Coatings	340
35)	Tile and Stone Sealers	100
36)	Traffic Marking Coatings	100
37)	Tub and Tile refinish Coatings	420
38)	Waterproofing Membranes	100
39)	Wood Coatings	275
40)	Wood Preservatives	350
41)	Zinc-rich Primers	340

2.5 INTERIOR COATINGS

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied coating used on the interior of this Project shall not exceed the limits defined in Rule 1113 - "Architectural Coatings" of the South Coast Air Quality Management District (SCAQMD), of the State of California, Amended February 5, 2016.
2. The VOC limits defined by SCAQMD are measured in grams per liter (g/L), less water and less exempt compounds.

3. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
4. General: For specified building construction related applications, the allowable VOC content is as follows:
 - a. Coatings
 - 1) Building Envelope Coatings 50
 - 2) Clear Wood Finish:
 - a) Varnish 275
 - b) Sanding Sealers 275
 - c) Lacquer 275
 - 3) Concrete-Curing Compounds 100
 - 4) Dry Fog Coatings 50
 - 5) Floor Coatings 50
 - 6) Low-solids Coatings 120*
 - 7) Magnesite Cement Coatings 450
 - 8) Primers, Sealers and Undercoaters 100
 - 9) Shellac
 - a) Clear 730
 - b) Pigmented 550
 - 10) Stains 100
 - 11) Waterproofing Sealers 100
 - 12) Waterproofing Concrete/Masonry Sealers 100
 - 13) Wood Preservatives 350

*Note: VOC levels for Low-Solids coatings are measured in grams of VOC per liter of material, including water.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. 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 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 3516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
 - 3. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
 - 4. Section 017300 "Execution" for cutting and patching procedures.
 - 5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach 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, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and 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.

1.4 MATERIALS OWNERSHIP

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

1.5 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Engineering Survey: Submit engineering survey of condition of building.
- 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 salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- E. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

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

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 that are not wanted by the Owner will be permitted on site where diversion of waste from landfill can be accomplished.
- 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 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 ANSI/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.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. 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.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 1. Comply with requirements specified in Section 013233 "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.

3.2 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 indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated 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 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.3 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.
- B. Temporary Shoring: 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.

3.4 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, to minimize disturbance of adjacent surfaces. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least four 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 017419 "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 designated by Owner.
 5. Protect items from damage during transport and storage.
 6. Salvage existing brick as indicated on drawings.
 7. Salvage existing Clay roof tiles as indicated on drawings
- 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.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, 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. Carpet Tile: Existing carpet tile that is not to be re-used: where indicated in the drawings, remove existing carpet and store for recycling. Contractor to verify with carpet tile manufacturer to be recycled and store as required for manufacturer pick-up and recycling, as indicated in section 01 3543 "Carpet Tile Reclamation".
- F. 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.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 7419 "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 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.7 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.

END OF SECTION

SECTION 03 01 00 – CONCRETE REPAIR

PART 1 GENERAL

1.01 DESCRIPTION

- A. This specification describes items common to all installations of concrete patching compounds.

1.02 GENERAL

- A. Wherever the words "approved by", "equivalent" or similar phrases are used in this specification, they shall be understood to mean that the material, process or item referred to shall require the written approval of the engineer.
- B. This specification shall be read in conjunction with project specifications, sketches, photographs and/or drawings indicating the precise extent of work and the use and location of specific materials.
- C. Contractor shall make a pre-bid field visit to verify all work shown or not shown on the drawings.

1.03 WORK INCLUDED

- A. Provide all labor, equipment and materials necessary to complete the following concrete repair work:
- B. Preparation of all surfaces to receive patching compound.
- C. Mixing and transportation of patching compound.
- D. Repairs to delaminated and scaled areas of existing concrete.
- E. Priming of repair areas and placement of patching compound, including priming of reinforcement.
- F. Finishing and curing of patches.
- G. Repair of cracks.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
- B. Submit the items in time to prevent delay of the work and to allow adequate time for review and resubmittals, if needed. Do not order materials or start work before receiving the written approval of substitutions.

1.05 QUALITY ASSURANCE

- A. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable concrete repair projects, and employing personnel skilled in the restoration process and operations indicated.

- B. Only skilled journeyman masons and/or cement finishers who are familiar and experienced with the materials and methods specified and are familiar with the design requirements shall be used for concrete restoration.
- C. One skilled journeyman mason or cement finisher, trained and certified by the concrete repair system manufacturer shall be present at all times during concrete restoration and shall personally direct the work.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
- B. Deliver and store restoration material in manufacturer's original, unopened containers with the grade, batch and production data shown on the container or packaging.
- C. Comply with manufacturer's recommendations for storage including minimum and maximum temperature requirements for storage.
- D. Comply with the manufacturer's written specifications and recommendations for mixing, application, and curing of grouts and patching materials.

1.07 SITE CONDITIONS

- A. Follow all manufacturer requirements for site conditions during placement and curing.

PART 2 PRODUCTS

2.01 GENERAL

- A. The products specified herein shall be assumed to meet the performance criteria specified. If a proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect, and shall be paid for by the submitting party.

2.02 CONCRETE REPAIR MATERIALS

- A. Sika VOH or approved equal
- B. Sika211 SCC Plus or approved equal
- C. Sika Armatex 110 Epochem or approved equal
- D. Sikadur35 Hi Mod Gel Cap or approved equal
- E. Flexi-Seal 510 or approved equal

2.03 WATERPROOFING MATERIALS

- A. Xypex Patch'n Plug or approved equal
- B. Xypex Concentrate Dry Pac or approved equal

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions under provisions of Section 1.7, this Specification.

3.02 REPAIR PROCEDURE

- A. Concrete repair procedure herein is suggested. Contractor may submit alternative procedures to the engineer for review and approval.
- B. Contractor shall note that the repair locations indicated herein are based on multiple site investigations but locations are not exact.
- C. The reinforcement shall be cleaned by wire brush to remove any loose, flaky rust, mill scale, and other coatings or foreign substances that would impair bonding of the repair material to the reinforcement. The repair area shall be free of chips, sawdust, debris, free water, or other harmful substances or coatings.
- D. All concrete to be repaired shall be cleaned to remove loose material.
- E. Unless otherwise specified, all concrete and other debris resulting from the repair works shall be removed from the site and disposed of at location(s) of the contractor's selection. The contractor is responsible for complying with all local, State, and Federal regulations pertaining to the disposal of such waste.
- F. All proprietary materials shall be applied in accordance with manufacturer's instructions.
- G. Procedure for cracks that extend through wall:
 - 1. Crack remediation shall be prior to application of Xypex waterproofing coating system.
 - 2. Refer to Method Statement "REPAIR OF CRACKS AND FAULTY CONSTRUCTION JOINTS" by Xypex
 - a. https://www.xypex.com/docs/default-source/technical/method-statements/repair-of-cracks-amp-faulty-construction-joints.pdf?sfvrsn=be960769_12
 - 3. Prepare surface in accordance with manufacturer's instructions
 - 4. Chip out designated cracks a minimum 1.5" deep x 1" wide on wet side to receive repair
 - 5. Apply a 3/4" lift of Xypex Patch 'N Plug
 - 6. Apply a 3/4" lift of Xypex Dry Pack
 - 7. Proceed to waterproofing procedure per Architect.
- H. Procedure of cracks at face of concrete walls and face of concrete beams in basement, less than 1/8" in width:
 - 1. Crack sealant for small cracks on non-water positive face shall be a 100% solids, 2-component elastomeric epoxy with 110% elongation and minimum 1200 psi tensile strength as measured by ASTM D412. Sealant shall be Flexi-Seal 510 as manufactured by Edison Coatings, Inc. (800) 697-8055, or approved equal.
- I. Procedure for concrete spalls overhead:
 - 1. For any exposed reinforcement, apply Sika Armatex 110 Epochem bonding agent.
 - 2. Concrete substrate must be saturated surface dry (ssd) with no standing water. Allow application to dry completely before repair mortar or concrete is applied.
 - 3. Replace lost section w/ Sikatop VOH repair mortar matching existing member depth.

4. Hand-applied mortar shall be applied in lifts no less than 1/8" and no greater than 3" thickness.
- J. Procedure for concrete spalls at concrete beams and columns:
 1. Minimum depth repair area = 1" depth. Chip concrete as required to provide minimum depth of repair.
 2. For any exposed reinforcement, apply Sika Armathec 110 Epochem bonding agent.
 - a. Concrete substrate must be saturated surface dry (ssd) with no standing water. Allow application to dry completely before repair mortar or concrete is applied.
 3. Replace lost section w/ Sika211 SCC Plus matching existing member depth.
- K. Procedure for waterproofing of concrete walls:
 1. Refer to Architect's specification.

3.03 FIELD QUALITY CONTROL

- A. Visual inspection by the EOR does not guarantee the Contractor's work, the product's effectiveness, or alleviate the Contractor from final responsibility to place repair materials in accordance with the Contract Drawings and Specifications.

END OF SECTION 03 01 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Concrete reinforcement.
 - 2. Concrete formwork.
 - 3. Cast-in-place concrete.
 - 4. Incidental items required to complete the work.

1.02 REFERENCES

- A. General:
 - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
 - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- B. American Concrete Institute (ACI):
 - 1. ACI 117 – Tolerances for Concrete Construction
 - 2. ACI 211.1 - Proportions for Normal, Heavyweight and Mass Concrete
 - 3. ACI 301 - Specifications for Structural Concrete
 - 4. ACI 303R - Guide to Cast-In-Place Architectural Concrete Practice
 - 5. ACI 305.1 - Specification for Hot Weather Concreting
 - 6. ACI 306.1 - Standard Specification for Cold Weather Concreting
 - 7. ACI 308.1 - Specification for Curing Concrete
 - 8. ACI 309 - Consolidation of Concrete
 - 9. ACI 315 – Standard Practice for Detailing Reinforced Concrete Structures
 - 10. ACI 318 - Building Code Requirements for Structural Concrete
 - 11. ACI 347 – Guide to Formwork for Concrete
- C. ASTM International:
 - 1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A970 Standard Specification for Headed Steel Bars for Concrete Reinforcement
 - 4. ASTM C31 - Making and Curing Concrete Test Specimens in the Field
 - 5. ASTM C33 - Concrete Aggregates
 - 6. ASTM C94 - Ready Mix Concrete
 - 7. ASTM C143 - Test Method for Slump of Portland Cement Concrete
 - 8. ASTM C150 - Portland Cement
 - 9. ASTM C156 - Test Method for Water Retention by Concrete Curing Materials

10. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
 11. ASTM C171 - Sheet Materials for Curing Concrete
 12. ASTM C172 - Sampling of Freshly Mixed Concrete
 13. ASTM C260 - Air Entraining Admixtures for Concrete
 14. ASTM C309 Liquid Membrane - Forming Compounds for Curing Concrete
 15. ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 16. ASTM C330 - Lightweight Aggregates for Structural Concrete
 17. ASTM C494 - Chemical Admixtures for Concrete
 18. ASTM C567 - Test Method for Unit Weight of Structural Lightweight Concrete
 19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 20. ASTM C881 - Epoxy - Resin - Base Bonding Systems for Concrete
 21. ASTM E1745 - Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
- D. American Institute of Steel Construction (AISC) Code of Standard Practice
- E. CRSI – Manual of Standard Practice

1.03 SUBMITTALS

- A. Reinforcement
1. Reinforcement Shop Drawings: Prepare placing drawings in accordance with ACI 315. Show size, shape and location of bars and wire fabric in structure. Show splice locations and lengths. Where details are not shown, conform to standards of practice indicated in ACI 315 and submit for approval.
 2. Submit manufacturer's certified mill test reports on each heat of reinforcing steel delivered, showing physical and chemical analysis before placing reinforcement.
- B. Concrete Materials
1. Concrete mix design for each concrete mix sealed by a professional engineer or record of verification by trial mixtures or historical data in accordance with ACI 318 and Quality Assurance requirements
 - a. Include compression test data used to establish mix proportions.
 2. Product Data: Provide data form proprietary materials, including admixtures curing materials, and finish materials.
 3. Samples: Only as requested by Architect's Representative.
- C. Concrete Formwork
1. Samples: Only as requested by Architect's Representative.
 2. Schedule showing Contractor's proposed location of construction joints not indicated on Drawings.
- D. Environmental Product Declaration
1. Provide an Environmental Product Declaration (EPD) for each required concrete mix to confirm GWP target is met.

1.04 QUALITY ASSURANCE

- A. Standards: Comply with provisions of ACI 301, except where more stringent requirements are shown or specified. Evaluation and acceptance of concrete structures will be in accordance with ACI 301.
- B. Survey anchor bolt location and elevations prior to casting concrete.
- C. Submit field test reports from the independent testing agency for review by the Architect. See Field Quality Control, this specification.
- D. Maintain positive identification of reinforcing by heat number. Provide certified mill test reports to Testing Laboratory.
 - 1. Where positive identification cannot be made and procedures are not deemed adequate to ensure compliance, Testing Laboratory will randomly sample and make one tensile and one bend test from each 2-1/2 tons or fraction thereof of each size of reinforcement. Contractor will bear the cost of testing.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Plywood, steel, fiberglass, reinforced plastic, or any material that will produce concrete with the required finish and within the specified tolerances.
 - 1. Use of aluminum form materials in contact with concrete is prohibited.
- B. Smooth Form Finish: PS1 plywood intended for concrete formwork, edge sealed, no mill oil. Type B-B Plyform, MDO or HDO overlain plywood.
 - 1. Where finish is exposed to view in completed construction, use only overlain plywood.

2.02 REINFORCING STEEL

- A. Fabricate reinforcement in accordance with ACI 315 where specific details are not shown.
- B. Bar Reinforcement: ASTM A615, Grade 60, deformed carbon bars.
 - 1. ASTM A706, only where noted on Drawings.
- C. Headed Bar Reinforcement: ASTM A970.
- D. Spirals: ASTM A1064.
- E. Welded Wire Fabric: ASTM A1064.
- F. Smooth Dowels, ASTM A615, Grade 60, smooth; sawcut or grind one end to remove offsets; shop paint with iron oxide zinc chromate primer.
- G. Reinforcement Accessories
 - 1. Tie Wire: Minimum 16-gage black annealed wire.
 - 2. Bar Supports:
- A. At surfaces not exposed to view in completed structure: Precast concrete bar supports with two 16 ga. embedded wires or CRSI Class 2 wire supports.
- B. Supports placed against ground or on top of vapor barrier: Precast concrete blocks not less than 3 inches square (1935 mm²) with two 16 ga embedded wires.
- C. At Architectural Concrete and surfaces exposed to weather: CRSI Class 2 stainless steel or CRSI Class 1 plastic protected.
- D. Where support is no closer to concrete surface than 1/2 inch (13 mm): CRSI Class 3 wire supports.

2.03 CONCRETE MATERIALS

- A. Cement: Type 1 ASTM C150, normal-weight unless noted otherwise.
- B. Cementitious materials and aggregates for exposed concrete shall be from same source throughout the work.
- C. Cementitious Material: An intimate blend of Portland cement and fly ash or other pozzolans listed below.
 - 1. Portland Cement: ASTM C150, Type II, low alkali.
 - 2. Fly Ash: ASTM C618, Class F.
 - 3. Slag Cement: ASTM C989, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C595, Type 1L, Portland-limestone cement.
 - 5. Silica Fume: ASTM C1240, amorphous silica.
 - 6. Ground Glass Pozzolan: ASTM C1866.
- D. Aggregate for Standard Weight Concrete: ASTM C33.
 - 1. Maximum size aggregate shall be 1-1/2" long for footings and 3/4" for wall and slabs.
- E. Aggregate for Lightweight Concrete: ASTM C330. Lightweight aggregate shall be vacuum saturated expanded shale or clay produced by rotary kiln.
- F. Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete: ASTM C1602.
- G. Admixtures:
 - 1. General:
 - a. Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized.
 - b. Liquid admixtures shall be considered part of the total water.
- H. Waterproofing Admixture:
 - 1. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.
 - 2. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.
 - 3. The concrete crystalline waterproofing admixture shall be specifically formulated as a concrete admixture.
 - 4. Xypex Admix C-1000.
 - 5. The dosage rate for the Xypex Admix C-1000 shall be 3% by weight of cement.
 - 6. Crack Bridging Capability: Requirement: Crystalline Waterproofing shall be capable of
 - 7. sealing static cracks up to 1/64".
- I. Lightweight Concrete shall contain an air entrainment admixture conforming to ASTM C260, to produce an air content of 3 to 5 percent at point of placement.
- J. Water Reducing Admixture: ASTM C494, Type A. Provide in all concrete at necessary dosage to facilitate placement.
- K. Mid to High Range Water Reducing Admixture: ASTM C494, Type F; polycarboxylate formulation. Provide in mid-range or high-range dosage as necessary for placement at the maximum water to cement ratio specified.

- L. Set Accelerating Admixture: ASTM C494, Type E, non-chloride. Subject to approval of Architect's Representative, provide in necessary dosage to accelerate set.
- M. Set Retarding Admixture: ASTM C494, Type D. Subject to approval of Architect's Representative, provide in necessary dosage to retard set.
- N. Color Admixtures: ASTM C579.

2.04 ACCESSORIES

- A. Form Ties: Snap off metal tie of fixed length with plastic cone, designed to prevent spalling of concrete upon removal. Provide units that will leave no metal within 1-inch (25 mm) of concrete surface.
- B. Form Release Agent: Water-based, colorless, nonstaining, chemically active agent that shall not impair bonding of paint or other coatings intended for use. Formulated for use on form facing material.
 - 1. Lumber, plywood or MDO overlain plywood: Aqua-Nox F by Nox-crete, or approved equal.
 - 2. HDO overlain plywood, steel or fiberglass: Nox-crete PCE by nox-crete, or approved equal.
- C. Expansion Joint Filler: Preformed asphalt impregnated fiber, ASTM D1751, 1/2 inch thick, unless otherwise noted.
- D. Curing Compounds: ASTM C309, which will not discolor concrete or affect bonding of other finishes applied thereover, and which restricts loss of water to not more than 0.500 grams per square centimeter of surface when tested per ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."
 - 1. Type 1 Clear, Liquid membrane-forming compound, Class A Unrestricted
- E. Slab Curing Membrane: Membrane conforming to ASTM C171, non-staining.
- F. Burlap Sheet: AASHTO M182, class 3 or 4.
- G. Surface Hardener: Lapidolith, Hornolith, Kemi-Kal Liquid or equal.
- H. Rock Base: Clean, hard and durable gravel or crushed rock.
- I. Vapor Barrier: Polyethylene sheet not less than 10 mils thick that is resistant to deterioration when tested according to ASTM E 154
 - 1. Lap 12" to accommodate pouring direction
- J. Sand Cover: See Section 31 23 23 Select Fill and Backfill
 - 1. Note native, uncompacted soil is acceptable backfill of pile-supported slabs.
 - 2. "Dry bottom" slabs for pile cap or grade beam formation, if elected by the Contractor, shall be Select Fill.
- K. Geofoam or Closed Cell Extruded Polystyrene (EPS): ASTM D6817, nominal density = 15psi, basis of design = EPS15 w termicide.
- L. Waterstops: Waterstop-RX Volclay waterproofing by American Colloid Company or approved equal unless noted otherwise.

2.05 CONCRETE MIXES

- A. Strength: Minimum compressive strength in psi per Design Drawings, tested in accordance with ASTM C39.
- B. See Drawings for specific concrete mix requirements, including Global Warming Potential (GWP) maximum.

- C. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 EXECUTION

3.01 CONSTRUCTION OF FORMS

- A. Design, construct and maintain formwork in accordance with ACI 347.
- B. Provide positive means of adjustment, such as wedges and jacks, or shores and struts. Adjust formwork before and during concrete placement to achieve the specified tolerances.
- C. Tolerances: Finished work shall conform to tolerances of ACI 117.
 - 1. Tolerance for offsets at panel edges in as-cast condition shall conform to ACI 117, Class A for Architectural Concrete, Class B for other surfaces exposed to view, and Class C for all other surfaces.
- D. Construct forms mortar-tight and in a manner to permit removal without damaging the concrete.
- E. Verify that sleeves and other openings, offsets, recesses, channel chases, anchors, ties and inserts are in place before concrete is placed.
- F. Earth Forms: Footing forms may be omitted and foundation concrete may be placed directly into neatly and accurately cut excavations, provided the excavation walls are stable, a minimum of one inch and maximum of three inches outside the concrete edges indicated on the drawings.
 - 1. Where sides are unstable or excavations are not accurately cut to tolerances of ACI 301, construct formwork to the extent required, at no additional cost to Owner.
 - 2. Hand trim sides and bottom of earth forms; remove loose dirt prior to placing concrete.
- G. Provide temporary openings in formwork at the base of wall and column forms to allow inspection and cleaning before concrete placement.
- H. Provide blockouts for mechanical and electrical work wherever necessary, even though not shown on the Drawings.
- I. Provide 3/4-inch (19 mm) chamfers for external corners.
- J. Plywood Forms at Exposed Surfaces:
 - 1. Keep number of panel joints to practical minimum.
 - 2. Ensure vertical joints are plumb and horizontal joints are level.
 - 3. Align form ties vertically and horizontally.
- K. Shoring: Shores and struts, if deemed required by Contractor as a part of their means and methods, shall be provided with positive means of adjustment and settlement shall be taken up during construction.
- L. Form Release Agent: Apply a coating of form release agent immediately before use, but prior to installation of reinforcing steel and embedded items.
- M. Construction Joints:
 - 1. Provide where shown or noted on the Drawings or as approved by the Architect.
 - 2. Provide key indentations at formed joints.
 - 3. Prevent formation of shoulders and ledges.
- N. Waterstops: Install in construction joints where shown or noted on Drawings. Install in accordance with manufacturer's written instructions, including location, surface preparation, adhesive primer, and butting or lapping of ends.

- O. Expansion Joints: Provide expansion joints and isolation joints where shown or noted on Drawings. Place joint filler in straight line with edge held back 1/8 inch (3 mm) from concrete surface and secured to formwork or previously placed construction.
 - 1. Hold edge back by width of joint where joints are scheduled to receive sealant.

3.02 REMOVAL OF FORMWORK

- A. Do not remove forms until concrete has hardened and attained sufficient strength to permit safe removal and adequate support of inherent and imposed loads. It shall be the Contractor's responsibility to limit construction loads to those which can be carried safely by the developed strength of the structure at the time of loading and by formwork and shoring in-place at the time of loading.
- B. Remove forms carefully to avoid damaging corners and edges of exposed concrete. Prying against the face of concrete shall not be allowed.
- C. After concrete is placed, forms and shores shall remain in place for not less than the following period of time, subject to requirements for additional curing:
 - 1. Columns: 24 hours, unless otherwise noted.
 - 2. Walls: 2 days, unless otherwise noted. 7 days for Architectural Concrete and other concrete surfaces exposed at building exterior.
 - 3. Beams Sides: 2 days, unless otherwise noted.
 - 4. Beam Soffits: Maintain formwork 7 days; shore until concrete achieves design compressive strength, 7 days minimum.
 - 5. One-Way Slab Soffits: Maintain formwork 7 days; shore until concrete achieves design compressive strength, 7 days minimum.
 - 6. Flat Slabs: Maintain form facing material 7 days; shore until concrete achieves design compressive strength, 21 days minimum.
- A. Upon removal of form facing material, install reshores as soon as practical, but not longer than 4 hours after stripping.
- D. Where concrete placing continues on upper levels, shoring may be required to be in place longer than minimum time noted for purpose of supporting weight of floor or roof pours above.
- E. Where forms are removed in less than 7 days, curing shall be continued as follows:
 - 1. Immediately following form removal thoroughly wet surface.
 - 2. Continue curing in accordance with provisions of Division 03 Section "Cast-in-Place Concrete".
- F. Reuse of Forms: Forms may be reused provided they are straight, clean, free from nails, dirt, hardened concrete, rust, and other injurious matter and edges and surfaces are in good condition.
 - 1. Clean and repair damage caused by placing, removal, or storage. Reuse of formwork that would reduce quality of exposed-to-view concrete will not be permitted.
 - 2. Forms shall not be reused for Architectural Concrete if there is evidence of surface wear or defect that would impair the quality of the surface.

3.03 REINFORCEMENT & EMBEDDED ITEMS

- A. Place, support, and secure reinforcement and embedded items against displacement.
- B. Surface Condition of Reinforcement: Before placing concrete, clean reinforcement of loose scale, dirt, grease and other substances which would impair bond with concrete.
- C. Place reinforcement in accordance with the Drawings and the CRSI Manual.

- D. Place reinforcing bars accurately as to spacing and clearance and securely tied at intersections and supports with wire and in such a manner as will preclude displacement during pouring of concrete. Placing tolerances shall be in conformance with the requirements of ACI 117.
- E. Place and secure reinforcement to maintain the proper distance and clearance between parallel bars and from the forms. Provide vertical steel with metal spreaders to maintain steel properly centered in the forms. Horizontal reinforcement shall be supported at proper height on concrete pads, chairs or transverse steel bars.
- F. After placing, maintain bars in a clean condition until completely embedded in concrete.
- G. Bars shall not be spaced closer than 1-1/2 diameters of the largest of two adjacent bars, 1-1/2 times the maximum aggregate size, nor one inch, except at bar laps. Where reinforcement in members is placed in two layers, the clear distance between layers shall be not less than one inch (25 mm) or more than 1-1/2 inches (13 mm) unless otherwise noted on the drawings. The bars in the upper layer shall be placed directly above those in the bottom layer unless otherwise detailed.
- H. Coverage of bars shall be as shown and scheduled. Conform to ACI 301 where not indicated.
- I. Where obstruction prevents the intended placement of reinforcement, provide additional reinforcement as directed by the Engineer around the obstruction.
- J. Splice bars as indicated by lapping and securely wiring together. Bars shall be spread the minimum distance specified. Stagger splices of adjacent bars where possible.
- K. Reinforcing bars shall not have welded joints.
- L. Installation tolerances for anchor bolts for structural steel columns shall comply with the AISC Code of Standard Practice tolerances.
- M. Provide lap splices, standard hooks, and corner bars as indicated on the Drawings
- N. Provide suitable wire spacers, chairs, ties, brickettes etc. for supporting reinforcing steel in the proper position while placing concrete. Do not "wet stick" dowels.
- O. Locations and sizes of openings, sleeves, etc. required for other trades must be verified by these trades before placing concrete.
- P. All slots, sleeves, trenches, and other embedded items shall be set and secured against movement before the concrete is placed. See Architectural, Electrical, Mechanical, Plumbing, Vendor drawings, etc. for sizes and locations.
- Q. Conduits and pipes embedded in concrete slabs may be no larger than 1/3 of the slab thickness (based on the maximum outside diameter) and shall have a center-to-center spacing no less than three (3) conduit diameters. Regardless of diameter, the minimum clear spacing between conduits or reinforcing shall be one (1) inch.
- R. No aluminum conduits, devices, or fixtures may be embedded into the concrete so that the aluminum is in direct contact with the concrete.
- S. No conduits shall be placed in slabs within 12 inches of column face or face of bearing wall.
- T. Provide waterstops at the bottom of all elevator pit walls, all four sides, regardless of whether noted on the drawings.

3.04 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.

- B. Verify that anchor bolts, embedded plates, reinforcement, sleeves and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- C. Periodic visually inspection of placement of reinforcement for conformance with the Contract Documents and as required by IBC Chapter 17.

3.05 PLACING CONCRETE

- A. Notify the Architect at least 48 hours prior to commencement of concreting operations. No concrete shall be placed until all subgrade, formwork, reinforcing steel, embedded items and surfaces against which concrete is to be placed have been accepted by the Architect. The rate of delivery, haul time, missing time and hopper capacity shall be such that all mixed concrete delivered shall be placed in forms within 90 minutes from the time of the introduction of cement and water into the mixer.
- B. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instruction.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy grout.
- D. Foundation surfaces against which concrete is to be placed must be free from standing water, mud and debris. Surfaces shall be clean and free from oil, objectionable coatings, and loose or unsound material.
- E. All surfaces of forms and embedded items shall be free of grout before placing concrete.
- F. Location of construction joints shall be as shown on the structural drawings.
- G. When ambient temperature is expected to exceed 80°F during placing or finishing operations, steps shall be taken in accordance with ACI 305, "Recommended Practices for Hot Weather Concreting"
- H. When ambient temperature is expected to be below 40°F during placing or finishing operations, steps shall be taken in accordance with ACI 306, "Recommended Practices for Cold Weather Concreting".

3.06 FLOOR SLABS

- A. Place floor slabs as indicated on Drawings. Saw cut control joints at an optimum time after finishing. Cut slabs with a 3/16-inch thick blade to 1 inch depth.
- B. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.
- C. Finish surfaces as scheduled.
- D. Install joint devices and joint device anchors in accordance with manufacturer's instructions. Maintain correct position to allow joint cover flush with floor finish.
- E. Construct slab on grade and shored elevated floor slabs with overall specified FF25/FL20 and with minimum FF20/FL15 for individual floor sections in accordance with ACI 302.1. Determination of FF/FL numbers will be in accordance with ASTM E 1155.
- F. Where control joints are required, saw cuts shall be made as soon as the concrete can support the saw without damaging the surface. Maximum (8) hours after the start of concrete pour.

3.07 CURING AND PROTECTION

- A. Wheeling, working and walking on concrete shall be avoided for at least 24 hours after casting. Protect concrete from sun and rain. Do not permit concrete to become dry during curing period. Concrete shall not be subjected to any loads until concrete is completely cured, and until concrete has attained its 28-day strength.
- B. Protect concrete during and after curing from damage during subsequent building construction operations.
- C. Cover traffic areas with plywood or other suitable means for as long as necessary to protect concrete from damage.
- D. Concrete may be cured with the application of a curing blanket as described below or the use of a curing compound following the requirements of Section 2.04 or another alternative curing plan requested by the Contractor. It is the responsibility of the Contractor to adequately cure the concrete. Engineer of record is not responsible for non-structural shrinkage cracking that may occur with inadequate curing practices or with the substitution of a curing compound in lieu of curing blankets.
 - 1. Immediately upon completion of finishing operation, the surface of slabs shall be sealed against moisture loss by the application of a curing blanket made of polyethylene bonded to burlap in accordance with the manufacturer's instructions. Alternatively, waterproof curing paper may be used with edges lapped and sealed with tape. The curing membrane shall be weighted down. Tears and rips in curing membrane shall be repaired immediately during curing period. Curing shall be maintained for 7 days.
- E. Minimum curing requirements for walls, beams and columns shall include the following unless Contractor elects to submit an alternative plan: Concrete in forms shall be kept moist until removal. Immediately upon removal of forms, an approved sprayed-on curing compound shall be applied to the concrete surfaces in strict compliance with the manufacturer's recommendations. Curing shall be maintained for 7 days.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner or Contractor will engage a qualified testing agency to perform material tests and inspections.
- B. Tests: Perform according to ACI 301.
 - 1. Definition of (1) set: minimum (3) cylinders for testing at (7) days, (3) cylinders for testing at (28) days, and additional (3) cylinders for reserve. Sample in accordance with ASTM C172.
 - 2. Testing Frequency: Obtain at least (1) set of cylinders for each 100 cubic yd. or fraction thereof of each concrete mixture placed each day. Minimum (1) set of cylinders per day of concrete placement.
 - 3. Samples shall be properly cured and stored. Prepare cylinders in accordance with ASTM C31.
 - 4. Test concrete cylinders in accordance with ASTM C39 by a qualified Testing Agency and submit results to Architect for review within (3) days.
 - 5. Testing Agency will provide slump tests per ASTM C143 air content testing per ASTM C231 or C173, temperature by ASTM C1064, density by ASTM C138 in the field for each set of cylinders or minimum (1) test each per day of concrete placement. Results shall be submitted to the Architect for review within (3) days.
- C. Visual inspection by the EOR does not guarantee the Contractor's work or alleviate the Contractor from final responsibility to place reinforcement and concrete in accordance with the Contract Drawings and Specifications.

EDR Project No. 22071
December 18, 2025
END OF SECTION 03 30 00

Odenheimer Building
Construction Documents

SECTION 03 3500

UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor barrier and installation accessories for installation under concrete slabs.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E1745- 11Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings:
 - 1. Provide sequencing diagram for each type, including a timeline for ultra-violet light and atmospheric exposure.
- D. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E 1745.
 - 2. Manufacturer's samples and literature.
 - 3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.
 - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

5. Contractor ABAA / BPQI (Building Performance Quality Institute) Accreditation; maintain throughout project.
6. Provide manufacturer written approval of compatibility and integration with adjacent waterproofing materials.

1.5 INFORMATIONAL SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section.
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 1. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 MATERIALS

- A. Vapor barrier shall have all of the following qualities:
 1. Maintain permeance of less than 0.01 perm as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
- B. Vapor barrier products:
 1. Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
 2. Griffolyn G15 by Reef Industries, Inc
 3. Vaporflex 15 by Layfield

2.3 ACCESSORIES

- A. Seams: provide seaming tape suitable to manufacturer.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Penetrations of Vapor barrier: Provide mastic and tape suitable to manufacturer.
- D. Perimeter/edge seal: provide termination bars, clamps and double-sided tape suitable to manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Geotechnical Engineer.
 - 1. Level and compact base material.

3.2 INSTALLATION

- A. Sheet Vapor Barriers: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. Install as continuous membrane, unbroken and undamaged.
 - 3. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
 - 4. Seal vapor barrier to slab perimeter/edge or footing/grade beam with double sided tape, termination bar, or both, or as shown. Remove dirt, debris, mud and ponding water prior to concrete placement.
 - 5. Overlap joints 6 inches and seal with manufacturer's tape.
 - 6. Pitch-pockets prohibited.
 - 7. Provide 6-inch baffle at all terminations, coordination with item 4 above to allow for movement during concrete placement.
 - 8. Apply seam tape to a clean and dry vapor barrier.
 - 9. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 10. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - 11. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape. Photo document each repair and location.
 - 12. Keep vapor barrier free from standing water.
 - 13. Remove standing water (ponding) located on installed vapor barrier prior to pouring of concrete slabs.
 - 14. Protect membrane from overhead welding operations.
 - 15. Describe repair procedures for membrane in Quality Control section.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage site representative qualified by membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish report to Architect prior to concrete placement.

END OF SECTION

SECTION 03 3540

CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Application of clear reactive, penetrating liquid hardener to interior concrete.
 - 2. Refining the interior concrete slab with a high grit diamond impregnated burnishing system.
 - 3. Application of stain resistant surface treatment
- B. Related Requirements:
 - 1. Section 03 3000 "Cast-in-Place Concrete" for concrete not designated as burnished concrete.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of burnished concrete.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Convene before the start of work on new concrete slabs, patching of concrete slabs and start of application of concrete finish system.
 - 2. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with burnished concrete to attend, including the following:
 - a. All parties that influence the results of the burnishing process must attend including Burnishing/Processing Installer, Flat Work Contractor, Architect, Contractor and Parties responsible for assuring concrete mix design.
 - 3. Review the following:
 - a. Physical requirements of completed concrete slab and slab finish.
 - b. Locations and time of test areas.
 - c. Protection of surfaces not scheduled for finish application.
 - d. Cold- and hot-weather concreting procedures, curing procedures, construction joints, and concrete repair procedures.
 - e. Surface preparation.
 - f. Application procedure.
 - g. Dust control measures, partitioning of existing spaces, sealing of all penetrations and ductwork to prevent dust mitigation into building systems.
 - h. Timing of work.
 - i. Protection of finish system.
 - j. Coordination with other work.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Manufacturer and model of all abrasives.
 - 2. Manufacturer and model of equipment that mechanically rotate abrasives.
 - 3. Manufacturer, product and technical data sheet of Hardener / Densifier.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients: Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples for Initial Selection: For each type of product requiring color selection.
- D. Samples for Verification: For each type of exposed color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer of system and for Installer. Include lists of completed projects with project names and addresses and names and addresses of architects.
 - 1. Maintenance:
 - a. Installers cleaning and maintenance recommendations for finished surface.
- B. Certificates: Certificates by manufacturer stating that installer is listed applicator of special concrete finishes, and has completed the necessary training programs.
- C. Floor Protection Plan.
- D. Laminated Maintenance Instructions: Operation and maintenance instructions for installed concrete flooring products in accordance with Division 1 Closeout Submittals Section. Include methods for maintaining final finish gloss and cleanliness of concrete slab surface.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.7 QUALITY ASSURANCE

- A. Installer's Qualifications
 - 1. Applicator to be familiar with the specified requirements and the methods needed for proper performance of work of this section. Applicator must have availability of proper equipment to perform work within scope of this project on a timely basis. Applicator should have successfully performed a minimum of 5 projects of similar scope and complexity.

- B. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals.
 - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove field sample panels when directed.
- C. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of burnishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing:
 - 1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
 - 2. Concrete shall be same mix design as scheduled for Project.
 - 3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
 - 4. Perform work as scheduled for Project using same personnel as will perform work for Project.
 - 5. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified finished gloss level.
 - 6. Obtain Architect's approval before starting work on Project.
 - 7. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.
- B. Store concrete hardener/densifier and surface protectant treatment in environment recommended on published manufacturer's product data sheets.

1.9 FIELD CONDITIONS

- A. Traffic Control:
 - 1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - 2. Close areas to traffic during floor application and after application for time period recommended in writing by manufacturer.
 - 3. Protect the completed slab to prevent damage by the other trades during floor completion.
- B. Temperature Limitations:
 - 1. Apply when surface and air temperature are between 40 degrees F (4 degrees C) and 95 degrees F (35 degrees C) unless otherwise indicated by manufacturer's written instructions.
 - 2. Apply when surface and air temperatures are expected to remain above 40 degrees F (4 degrees C) for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- C. Apply when air conditions are calm to minimize surface treatment contacting surface not intended to be finished.

- D. Do not apply to frozen substrate. Allow adequate time for substrate to thaw if freezing conditions exist before application.
- E. Apply a minimum of 24 hours after rain event. Suspend application when rain is anticipated for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- F. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- G. Ventilation: Provide adequate ventilation in confined or enclosed areas in accordance with manufacturer's instructions.

1.10 WARRANTY

- A. The hardener or densifier manufacturer shall furnish a minimum 10-year material limited warranty, from the date of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Environmental Limitations:
 - 1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.
 - 2. Application of finish system shall take place a minimum of 21 days prior to fixture and trim installation.
 - 3. Finish concrete area shall be closed to traffic during finish floor application and after application for the time as recommended by manufacturer.

2.2 MATERIALS

- A. Hardness of abrasive must be matched with hardness of concrete. All resin abrasives must be from the same manufacturer, make and model.
- B. Dry Dust Vacuum system to include double filtration: A prefilter or cyclonic separator in addition to a high-efficiency particulate air (HEPA-13) filter. VDC system is equipped with static pressure gauge. If requested the manufacturer must supply 3 references of Installers currently using their equipment. System must capture dust and debris to meet OSHA air quality standards.

2.3 MATERIALS

- A. Pre-Densifier Concrete Cleaner: Cleaner to remove dirt, oil, grease, and other stains from existing slab surface.
 - 1. Product: Consolideck Cleaner/Degreaser manufactured by PROSOCO, Inc
 - 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Penetrating Concrete Hardener/Densifier: Lithium silicate hardener/densifier.
 - 1. Product: Consolideck LS, manufactured by PROSOCO, Inc.
 - 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - a. Comply with national, state and district AIM VOC regulations and contain 50 g/L or less.
 - b. Abrasion Resistance: Greater than 50 percent improvement over untreated samples when tested in accordance with ASTM C1353.
 - c. Achieve 'High Traction Range' readings when tested in accordance with ANSI B101.1 and ANSI B101.3.
 - d. Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - e. Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - f. Water Vapor Transmission: 100 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
 - g. UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.
- C. Interior Concrete Protective Treatments:
 - 1. General Purpose high-gloss film forming premium sealer, lithium silicate hardener/densifier
 - 2. General Purpose medium gloss, film forming sealer.
 - a. Product: Consolideck PolishGuard, manufactured by PROSOCO, Inc.,
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - c. Subject to compliance with the following requirements:
 - 1) Comply with national, state and district AIM VOC regulations.
 - 2) Achieve 'High Traction Range' readings when tested in accordance with ANSI B101.1 and ANSI B101.3.
 - 3) Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.

- 4) Stain Resistance: Achieve limited or no adverse effects when tested in accordance with ASTM D1308.
- 5) UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.

2.4 EQUIPMENT

- A. Auto Scrubber Machine: For cleaning operations.
- B. Burnishing Machine and Burnishing Pads to produce specified results.
 1. Burnishing Machine: High speed burnisher, generating pad speeds of 1,500 RPM or higher, as recommended by protective treatment manufacturer. Dust skirt must be installed at time of work.
 2. Diamond Impregnated Burnishing Pads:
 - a. Resin Diamond Pad Grit Sizes: 800, 1500 or 3000 grit.

2.5 CONCRETE MAINTENANCE SUPPLIES

- A. Concrete Maintenance Cleaner: Lithium silicate concentrated maintenance cleaner to keep maintain concrete surface sheen and remove dirt and soils.
 1. [Consolideck LSKlean ULTRA](#) 30, pre-measured 4 oz packs, manufactured by PROSOCO, Inc., www.prosoco.com, (NO SUBSTITUTE).
- B. Floor Maintenance Pads:
 1. White floor maintenance pads.
- C. Spill Clean-up Kit: Provide critical cleaning items to remove spills from concrete floors. Spill Clean-up Kit should include the following:
 1. One quart of Consolideck Cleaner Degreaser, one quart of Consolideck Oil and Grease Remover, two pound Spill Guard Neutralizer Absorbent, one package of multi absorbent shop towels, one small plastic scraper, one hand broom and dust pan, a collapsible warning sign, 50 waste bags liners for 24 x 24 can liner, and one box of general purpose vinyl gloves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate with installer present for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

- A. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces.
- B. Remove remnants of curing compound, bond breaker, and construction laitance prior to application of densifier. Remove by cleaning and scrubbing in accordance with manufacturer's instructions.

- C. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.
- D. Scrub floor with pre-densifier floor cleaner to remove latent salts.
- E. Protect surrounding areas prior to application. If product is accidentally misapplied to adjacent surfaces, flush with water immediately before material dries.
- F. Avoid contact in areas not to be treated. Avoid contact with metal, glass and painted surfaces.
- G. Do not proceed until unsatisfactory conditions have been corrected.

3.3 APPLICATION OF CONCRETE HARDENER/DENSIFIER

- A. Cured Steel Troweled Concrete: Apply concrete hardener/densifier to cured steel troweled concrete. Apply according to manufacturer's written instructions and as follows:
 - 1. Remove remnants of bond breakers, curing agents, surface grease and oil and construction debris. Contact manufacturer for recommended cleaner and cleaning method.
 - 2. Apply hardener/densifier per manufacturer's recommended application rate to designated finished floor area, with a low pressure sprayer fitted with a 0.5 gpm spray tip.
 - 3. Apply sufficient material to wet the surface without producing puddles. Use a clean microfiber pad to spread the hardener/densifier evenly to achieve uniform wetting. Avoid spreading once drying begins. Surface should remain wet for 10 to 15 minutes. Avoid over-application. (Scrubbing is not necessary) Allow treated surface to dry.
 - 4. Apply second coat of concrete hardener/densifier, as necessary to product desired finishing results.
 - 5. Once thoroughly dry, concrete may be auto-scrubbed or burnished with slab surface refinement system.

3.4 INTERIOR CONCRETE SLAB SURFACE REFINEMENT SYSTEM

- A. Sequential progression of surface refinement shall be required and limited to no more than double the grit value of the previous diamond grit used after application of the concrete hardener/densifier.
- B. Overlap adjacent burnishing passes by 25 percent
- C. Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
- D. Progressively refine surface utilizing approved diamond impregnated burnishing system, to produce Finishing Requirements.

3.5 APPLICATION OF INTERIOR CONCRETE PROTECTIVE TREATMENT

- A. Application of general purpose, medium gloss protective treatment:
 - 1. Apply per manufacturer's published recommendations to clean, dry slab at the completion of mechanically burnishing the slab surface.
 - 2. Lightly wet a clean microfiber pad with general purpose, medium gloss protective treatment and wring out excess, leaving the pad damp.
 - 3. Spray-apply protective treatment using a clean, pump-up sprayer fitted with a 0.5 gpm conical or fan spray tip at an estimated coverage rate of 400 to 800 square feet per gallon. Work from one control joint to another.

4. Spread with the damp microfiber pad. Maintain a thin, even coating and wet edge. Stop spreading once drying begins. Do not overlap. Repeat steps 1 through 4. Two coats are recommended for maximum protection.
5. To increase gloss, wait at least 60 minutes after the final coat is applied, then use a high-speed burnisher fitted with a white burnishing pad. Burnish at a fast walking pace.

3.6 SLAB PROTECTION

- A. Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
- B. Do not drag or drop equipment or material across the slab which will scratch or chip it.
- C. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab.
- D. Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
- E. Develop a concrete protection procedure which addresses the following procedures:
 1. Communication of protection plan to subcontractors and vendors.
 2. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.
- F. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations.

3.7 FINISHING REQUIREMENTS

- A. Appearance:
 1. Interior exposed finished slab areas must consist of the following:
 - a. Slab surface must meet the desired sheen, as discussed in Pre-Installation meeting and be consistent with approved Mock-up.
 - b. Slab surface must have a consistent look and exhibit a finish that has no evidence of streaking or burnish marks.
 - c. White residue or hazy appearance is not acceptable.
 2. Interior exposed finished slab areas must consist of the following CPAA Gloss Level:
 - a. Finished Gloss Level 2 – Satin Gloss Appearance.

3.8 FIELD QUALITY CONTROL

- A. Concrete floors shall be tested for slip resistance by measuring the wet dynamic coefficient of friction using an approved tribometer according to ANSI B101.3 test method for measuring wet resistance potential rating of acceptable (not less than 0.30 for level surfaces or inclined surfaces)

END OF SECTION

SECTION 03 3543

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes polished concrete finishing for finish
 - 1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 03 3000 "Cast-in-Place Concrete."
- B. Related Requirements:
 - 1. Section 03 3000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Convene before the start of work on new concrete slabs, patching of concrete slabs and start of application of concrete finish system.
 - 2. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
 - a. All parties that influence the results of the polishing process must attend including Polishing/Processing Installer, Flat Work Contractor, Architect, Contractor and Parties responsible for assuring concrete mix design.
 - 3. Review the following:
 - a. Physical requirements of completed concrete slab and slab finish.
 - b. Locations and time of test areas.
 - c. Protection of surfaces not scheduled for finish application.
 - d. Cold- and hot-weather concreting procedures, curing procedures, construction joints, and concrete repair procedures.
 - e. Surface preparation.
 - f. Application procedure.
 - g. Dust control measures, partitioning of existing spaces, sealing of all penetrations and ductwork to prevent dust mitigation into building systems.
 - h. Timing of work.
 - i. Protection of finish system.
 - j. Coordination with other work.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Manufacturer and model of all abrasives.
 - 2. Manufacturer and model of equipment that mechanically rotate abrasives.
 - 3. Manufacturer, product and technical data sheet of Hardener / Densifier.
 - 4. For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Data:** For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Red List Compliance information: Provide documentation confirming no Red List chemical are present. Documentation to include one of the following:
 - a. Red List Free Declare ID number with VOC disclosure information.
 - b. Complete manufacturer-supplied ingredient list with a letter from the manufacturer confirming there are no Red List materials in proprietary ingredients.
 - 4. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples for Initial Selection: For each type of product requiring color selection.
- D. Samples for Verification: For each type of exposed color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer of polishing system and for Installer. Include lists of completed projects with project names and addresses, and names and addresses of architects.
 - 1. Installer's Qualifications
 - 2. Maintenance:
 - a. Installers cleaning and maintenance recommendations for finished surface.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Stain materials.
 - 3. Liquid floor treatments.
- C. Material Test Reports: For the following, by a qualified testing agency:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.7 QUALITY ASSURANCE

- A. Installer's Qualifications
 - 1. Applicator to be familiar with the specified requirements and the methods needed for proper performance of work of this section. Applicator must have availability of proper equipment to perform work within scope of this project on a timely basis. Applicator

should have successfully performed a minimum of 5 projects of similar scope and complexity.

- B. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
 - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove field sample panels when directed.
- C. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing:
 - 1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
 - 2. Concrete shall be same mix design as scheduled for Project.
 - 3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
 - 4. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
 - 5. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified aggregate exposure.
 - c. Compliance with specified finished gloss level.
 - 6. Obtain Architect's approval before starting work on Project.
 - 7. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.
- B. Store concrete hardener/densifier and surface protectant treatment in environment recommended on published manufacturer's product data sheets.

1.9 FIELD CONDITIONS

- A. Traffic Control:
 - 1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - 2. Close areas to traffic during floor application and after application for time period recommended in writing by manufacturer.
 - 3. Protect the completed slab to prevent damage by the other trades during floor completion.
- B. Temperature Limitations:
 - 1. Apply when surface and air temperature are between 40 degrees F (4 degrees C) and 95 degrees F (35 degrees C) unless otherwise indicated by manufacturer's written instructions.
 - 2. Apply when surface and air temperatures are expected to remain above 40 degrees F (4 degrees C) for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.

- C. Apply when air conditions are calm to minimize surface treatment contacting surface not intended to be finished.
- D. Do not apply to frozen substrate. Allow adequate time for substrate to thaw if freezing conditions exist before application.
- E. Apply a minimum of 24 hours after rain event. Suspend application when rain is anticipated for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- F. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- G. Ventilation: Provide adequate ventilation in confined or enclosed areas in accordance with manufacturer's instructions.

1.10 WARRANTY

- A. The hardener or densifier manufacturer shall furnish a minimum 10-year material limited warranty, from the date of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- E. Red List Compliance: Concrete finishing products cannot contain any Red List materials or chemical.
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- G. Environmental Limitations:
 - 1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.

- H. Environmental Limitations:
1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.
 2. Flatness and levelness:
 - a. Finish concrete shall have minimum floor flatness rating as follows:
 - 1) Overall FF: 50
 - 2) Local FF: 40
 - b. Finish concrete shall have a minimum floor levelness rating of at least 30.
 - c. Finish concrete shall be cured a minimum of 28 days or at which point equipment can be put on the slab and does not displace aggregate.
 3. Application of finish system shall take place a minimum of 21 days prior to fixture and trim installation.
 4. Finish concrete area shall be closed to traffic during finish floor application and after application for the time as recommended by manufacturer.

2.2 MATERIALS

- A. Hardness of abrasive must be matched with hardness of concrete. All resin abrasives must be from the same manufacturer, make and model.
- B. Grinding, Honing and Polishing Equipment:
1. Use planetary grinder capable of grinding within 1 inch of walls and columns.
- C. Dry Dust Vacuum system to include double filtration: A prefilter or cyclonic separator in addition to a high-efficiency particulate air (HEPA-13) filter. VDC system is equipped with static pressure gauge. If requested the manufacturer must supply 3 references of Installers currently using their equipment. System must capture dust and debris to meet OSHA air quality standards.
- D. Clear, water-based, blended surfactant cutting aid: Product used to extend the life of diamond tooling and minimize concrete surface scratches during the wet-grinding process.
1. Product: Consolideck First Cut manufactured by PROSOCO, Inc.
 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - a. Comply with national, state and district AIM VOC regulations and contains 0.5 g/L or less.
- E. Liquid Concrete Repair Material: Low-odor, liquid fill material used to fill pinholes, small air voids and pop-outs, micro-cracks and other gaps in concrete surface during grinding.
1. Product: Consolideck Grind-N-Fill manufactured by PROSOCO, Inc
 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - a. Comply with national, state and district AIM VOC regulations and contain 100 g/L or less.
- F. Pre-Densifier Concrete Cleaner: Cleaner to remove dirt, oil, grease, and other stains from existing slab surface.
1. Product: Consolideck Cleaner/Degreaser manufactured by PROSOCO, Inc
 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- G. Penetrating Concrete Hardener/Densifier: Lithium silicate hardener/densifier.
1. Product: Consolideck LS, manufactured by PROSOCO, Inc.

2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - a. Comply with national, state and district AIM VOC regulations and contain 50 g/L or less.
 - b. Abrasion Resistance: Greater than 50 percent improvement over untreated samples when tested in accordance with ASTM C1353.
 - c. Achieve 'High Traction Range' readings when tested in accordance with ANSI B101.1 and ANSI B101.3.
 - d. Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - e. Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - f. Water Vapor Transmission: 100 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
 - g. UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.
- H. Interior Concrete Protective Treatments:
 1. General Purpose high-gloss film forming premium sealer, lithium silicate hardener/densifier
 2. General Purpose medium gloss, film forming sealer.
 - a. Product: Consolideck PolishGuard, manufactured by PROSOCO, Inc.,
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - c. Subject to compliance with the following requirements:
 - 1) Comply with national, state and district AIM VOC regulations.
 - 2) Achieve 'High Traction Range' readings when tested in accordance with ANSI B101.1 and ANSI B101.3.
 - 3) Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - 4) Stain Resistance: Achieve limited or no adverse effects when tested in accordance with ASTM D1308.
 - 5) UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.

2.3 EQUIPMENT

- A. Auto Scrubber Machine: For cleaning operations.
- B. Hand Grinder or stand-up edger for edge grinding/polishing.
- C. Grinding/Polishing Equipment:
 1. Dry grinding/polishing machines shall include a dust extraction system, including HEPA filtration vacuum.
- D. Diamond Segments:
 1. Use heads from the same manufacturers throughout the entirety of the project.
- E. Diamond Heads Types:
 1. Metal Diamonds: 80 or 150.
 2. Hybrid Style Diamonds: 50 or 100.
 3. Resin Bonded, Phenolic Diamonds: 100, 200, 400, 800, 1500, and 3000 (if necessary).

- F. Burnishing Machine and Burnishing Pads to produce specified results.
 - 1. Burnishing Machine: High speed burnisher, generating pad speeds of 1,500 RPM or higher, as recommended by protective treatment manufacturer. Dust skirt must be installed at time of work.
 - 2. Burnishing Pads: as recommended by protective treatment manufacturer.
 - a. White Burnishing Pad, non-abrasive.
 - b. Consolideck Heat Pad manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.

2.4 ACCESSORIES

- A. Patching Compound: Compound composed of 40 percent Portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.
- B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.
- C. Patching and Fill Material: Epoxy matrix fill
- D. Joint Sealants: Recommended manufacturers and complying with requirements in Division 7 Section "Joint Sealants"
- E. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on floor type indicated

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate with installer present for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

- A. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces. Use appropriate concrete cleaners approved by the concrete surface treatment manufacturer where necessary. Rinse thoroughly using pressure water spray to remove cleaner residues. Allow surfaces to dry completely before application of product.
- B. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.
- C. Variations in substrate texture and color will affect final appearance and should be corrected prior to application of sealer/hardener system and the polishing steps.
- D. Protect surrounding areas prior to application. If product is accidentally misapplied to adjacent surfaces, flush with water immediately before material dries.

- E. Avoid contact in areas not to be treated. Avoid contact with metal, glass and painted surfaces.
- F. Seal open joints in accordance with Section 07 9200.
- G. Apply specified sealants and caulking and allow complete curing before application of penetrating concrete hardener/densifier.
- H. Do not proceed until unsatisfactory conditions have been corrected.

3.3 CONCRETE GRINDING, HONING, AND POLISHING

- A. Adhere to industry standard grinding, honing, and polishing procedures for dry and wet grinding and honing.
- B. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber between and after final passes.
- C. Sequential progression of diamond tooling steps shall be required and limited to no more than double the grit value of the previous diamonds used.
- D. Overlap adjacent passes by 25 percent.
- E. Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
- F. Progressively grind, hone and polish the slab surface utilizing approved diamond segments as necessary to produce Finishing requirements.
 - 1. Apply liquid concrete repair material to fill gaps, voids and pop-outs during grinding operation per manufacturer's published recommendations.
 - 2. Apply cutting aid chemical during the initial wet grinding process per manufacturer's published recommendations. (Typically before the 200 grit resin or lower).
- G. Perform Initial Grind to the following finish:
 - 1. Class B - Fine Aggregate (Salt and Pepper) Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
- H. Grouting: Fills pin holes and minor surface imperfections after initial grind is complete.

3.4 APPLICATION OF PENETRATING CONCRETE HARDENER/DENSIFIER

- A. Apply hardener/densifier at the rate of 500 to 700 square feet per gallon with a low pressure sprayer fitted with a 0.5 gpm spray tip. (Typically after 200-grit and no later than 400 grit).
- B. Apply sufficient material to keep concrete surface wet for 5 to 10 minute period, without producing puddles.
- C. Allow treated surface to dry.
- D. Continue progressively polishing floor with required resin diamonds as necessary to produce desired final finish.

3.5 POLISHING

- A. Polishing: provide tooling that has submitted to ST 115 testing and received certification.

- B. Polish:
 - 1. Level 2 – Medium Gloss Appearance:
 - a. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
 - b. Gloss Reading: Not less than 55 according to ASTM E 430 before polish guard application.
- C. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
 - 1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
 - 2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
 - 3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
 - 4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
 - 5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
 - 6. Control and dispose of waste products produced by grinding and polishing operations.
 - 7. Neutralize and clean polished floor surfaces.

3.6 APPLICATION OF INTERIOR CONCRETE PROTECTIVE TREATMENT

- A. Application of general purpose, medium gloss protective treatment:
 - 1. Apply per manufacturer's published recommendations to clean, dry slab at the completion of mechanically polishing the slab surface.
 - 2. Lightly wet a clean microfiber pad with general purpose, medium gloss protective treatment and wring out excess, leaving the pad damp.
 - 3. Spray-apply protective treatment using a clean, pump-up sprayer fitted with a 0.5 gpm conical or fan spray tip at an estimated coverage rate of 400 to 800 square feet per gallon. Work from one control joint to another.
 - 4. Spread with the damp microfiber pad. Maintain a thin, even coating and wet edge. Stop spreading once drying begins. Do not overlap. Repeat steps 1 through 4. Two coats are recommended for maximum protection.
 - 5. To increase gloss, wait at least 60 minutes after the final coat is applied, then use a high-speed burnisher fitted with a white polishing pad. Burnish at a fast walking pace.

3.7 SLAB PROTECTION

- A. Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
- B. Do not drag or drop equipment or material across the slab which will scratch or chip it.
- C. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab.
- D. Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
- E. Develop a concrete protection procedure which addresses the following procedures:
 - 1. Communication of protection plan to subcontractors and vendors.
 - 2. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.

- F. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations.

3.8 FINISHING REQUIREMENTS

- A. Appearance:
 - 1. Interior exposed finished slab areas must consist of the following:
 - a. Slab surface must meet the desired sheen, as discussed in Pre-Installation meeting and be consistent with approved Mock-up.
 - b. Slab surface must have a consistent look and exhibit a finish that has no evidence of streaking or burnish marks.
 - c. White residue or hazy appearance is not acceptable.
 - d. Exposure of aggregate beyond CPAA Class B - Fine Aggregate (Salt and Pepper) is not acceptable.
 - 2. Interior exposed finished slab areas must consist of the following CPAA Gloss Level:
 - a. Finished Gloss Level 2 – Satin Gloss Appearance.

3.9 FIELD QUALITY CONTROL

- A. Abrasive polished concrete floors shall be tested for slip resistance by measuring the wet dynamic coefficient of friction using an approved tribometer according to ANSI B101.3 test method for measuring wet resistance potential rating of acceptable (not less than 0.30 for level surfaces or inclined surfaces)

END OF SECTION

SECTION 03 37 12

EXHIBIT ROCKWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Work in this section shall be performed by an approved Rockwork Contractor, as defined in this Section, and include all labor, materials, and equipment to excavate, rough grade, finish grade and fabricate the work under this contract which includes the following interior and exterior features as illustrated on the drawings.
 - 1. Interior and Exterior Shotcrete Fabrications of highly natural appearance, including but not limited to the following:
 - a. Pools and streams.
 - b. Boulders and outcrops.
 - c. Mudbanks and planters.
 - 2. Provide Engineering calculations and professionally sealed drawings by a licensed engineer within project site jurisdiction for all work involving structural reinforcing.
 - 3. Painting, dying, tinting of new shotcrete rockwork for achieving the required finish.
 - 4. Drainage system for planters.
 - 5. Application of waterproofing systems in pools and raised planters, as indicated on drawings.
 - 6. All theme painting as shown in the Exhibit Rockwork Theming and Imagery at the end of this section.
 - 7. Theme painting of natural boulders as indicated on plans.
 - 8. Coordinating work with site utility & plumbing contractors for utility/plumbing components shown on details such as shotcrete water feature potable water supply and drainage.
- B. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete" for coordination with concrete walls.
 - 2. Division 04 Section "Concrete Unit Masonry" for coordination with CMU walls.
 - 3. Division 07 Section "Polymer Modified Cement Waterproofing" for surface applied waterproofing on shotcrete and masonry structures.
 - 4. Division 22 for coordination with plumbing on various plumbing components
 - 5. Division 33 for coordination with underground piping.

1.3 DEFINITIONS

- A. Approved Rockwork Contractor: Contractor whose proven experience, qualifications, and methods have been reviewed and accepted for the Work of this Section by CLR Design Inc.

and/or the Owner after submitting the required information indicated under the Quality Assurance paragraph of this Section.

- B. Artificial Geology (Rockwork) Definition: Shall consist of the construction and placement of the artificial features indicated on the Drawings and Specifications herein.
- C. Carved or Embossed Shotcrete: Shall consist of premixed fine aggregate and cement and water pneumatically placed or applied by suitable mechanism. Texture shall be by hand carving and embossing.

1.4 QUALITY ASSURANCE

- A. Experience and Qualification of Bidders: The Rockwork Contractor, in order to qualify as a specially skilled craftsman for the exhibit rockwork fabrication under this Work, shall demonstrate experience in:
 - 1. Specializing in the artistic construction of animal exhibit concrete work.
 - 2. Managing projects of this size and complexity.
 - 3. Coordination of this Work with other trades that affect this Work.
 - 4. Employing qualified and experienced craftspersons and artists.
- B. The Rockwork Contractor shall submit the following with the bid:
 - 1. A signed statement of experience certifying that the Contractor is an established business with a minimum of 8 years' experience and indicate in detail his experience in successfully constructing items described in paragraph 1.2.
 - 2. Photographic proof and reference material for evaluation of experience and ability to perform under this Work, including photographs (at least five (5) 8 ½" x 11" color photographs of previous comparable work) to show the Contractor's capabilities to construct the above mentioned items for natural habitat exhibits similar to those shown on the drawings, Contractor also to include a list of completed projects and references with demonstrate these capabilities. These projects and photographs of projects must have been the work of those craftsman and artist proposed for this work.
 - 3. Full documentation of the Construction crew, including resumes of lead personnel (on-site supervisor, and final texturing and finish experts, et al) lists of specific personnel to be used, and details of each listed person's experience and abilities to perform all phases of construction under this Work to the Architect's satisfaction. The assigned project on site supervisor and aesthetic coordinator's resume should show a minimum of five (5) years' experience in the management of project crews of no less than five (5) persons, as well as experience in coordination with other trades in the completion of simulated Rockwork fabrication projects Under the Work.
 - 4. Samples: See Article 1.8.
- C. The following is a non-restrictive list of pre-qualified Exhibitory Contractors, subject to compliance with the requirements of these specifications:
 - 1. Nassal Company, 415 W. Kaley Street, Orlando, FL 32806-3942; Phone: (407) 648-0400.
 - 2. Cemrock Landscapes, Inc., Attn: Christopher Conley, 4790 S. Julian Avenue, Tucson, AZ 85714; Phone: (520) 571-1999, Fax: (520) 571-1888.
 - 3. COST, Inc./Attn: Jeff Sheiber, 4201 Highway P. Jackson, Wisconsin 53037; Phone: (407)-816-2110 ext 2101. Website: www.cost-inc.com.
 - 4. Edge Themed Environments LLC./ Attn: Kyle Endres, 12615 Mukilteo Speedway, Lynnwood, WA 98087; Phone 425-482-3343; Website: www.edgethemed.com.

- D. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.
- B. Contractors wishing to be approved for Shotcrete and (artificial Rockwork) fabrication under this work may independently make application directly to the Architect as detailed above.
- C. The Architect/Exhibit Designer may require additional information and may request a visit to completed work in order to make a determination of the Contractor's qualification to produce exhibit artifacts with the required criteria under this Work. The Exhibit Designer may also require a submittal of a high-quality color video documentation of completed work.
- D. The Owner and Architect reserve the right to reject non-qualified Contractors, based on qualification submittals and, at their option, review of past work and references.

1.6 INTENT

- A. It is intended that the work involved create a highly natural appearance of the above-mentioned items as shown on the Drawings and Exhibit Images.
- B. The Contractor will perform this work under the direction of the Architect and will be expected to cooperate fully in this process.
- C. The Architect explicitly reserves the right to continuously monitor the work for aesthetic quality and functional criteria of the work as it is performed.
- D. The Exhibit Contractor is responsible to see that no loose materials used in the execution of this work remain after completion of the project.

1.7 COORDINATION

- A. The Rockwork Contractor shall fully coordinate with the other Contractors and their Sub-Contractors and the Architect. If the Rockwork Contractor suspects that a conflict may exist between work in this Section and any other work, he/she shall bring the issue to the attention of the Architect before proceeding.
- B. Coordinate with all other trades, placement of continuous waterstops where shotcrete pool construction adjoins work of other trades such as but not limited to retaining walls, building walls, and footings.
- C. Coordinate with irrigation installation.

1.8 MOCKUPS AND SAMPLES

- A. At least thirty days post-bid prior to beginning any exhibitry work, the Rockwork Contractor shall construct at the project site a mockup panel for each of the rockwork types listed in the Exhibit Rockwork Theming and Image Book to the Architect for approval. The types are reiterated in the following rockwork type list:

1. Pools and streams.
 2. Boulders and outcrops.
 3. Mudbanks and planters.
- B. Mockups shall represent finished surfaces with texturing, coloring, etching, etc.
- C. Mockups rejected by the Architect shall be reconstructed for approval by the Rockwork Contractor at no additional cost to the Owner.
- D. At the discretion of the Architect, mockup panels may be installed in their final location and used as part of the final work, if accepted.

1.9 ACTION SUBMITTALS

- A. All submittals shall be in accordance with - General Conditions for Submittals - Division 01 Section: "Submittal Procedures". The Rockwork Contractor shall submit the following shop drawings for review:
1. Layout Plan: The layout plan shall indicate and identify the following:
 - a. All rockwork by indicated categories.
 - b. Locations of all required footings and foundations.
 - c. Footing and foundation types and all pertinent dimensions.
 2. Steel Reinforcing: Indicate signs, types and locations of all steel reinforcing involved in Work of this Section. Provide the seal and signature of a licensed professional Engineer within project site jurisdiction to steel reinforcement shop drawings, indicating compliance with all government codes for reinforced concrete structures. Include structural calculations for all conditions.
 3. Literature, Specifications and Mix Designs: Submit all product literature, specifications and mix designs used in the production of rockwork.

1.10 PRE-CONSTRUCTION CONDITIONS

- A. All artificial rockwork locations shall be approved by the Architect prior to actual shotcrete application and texturing.
- B. Exhibit Rockwork Theming and Image Book: The Exhibit Images as provided by Architect indicates all rockwork color ranges, texture types, and respective location. For the purpose of duplicating three dimensionally the design concept and establishing the character, configuration and the amount of simulated rock to be constructed, the Rockwork Contractor shall work from drawings and photographs furnished by the Architect/Exhibit Designer. Exhibit Images are considered part of the contract documents.
- C. Structural Reinforcement: The structural reinforcement indicated in the specifications are to establish minimum design criteria for the Rockwork Contractor to incorporate into the rockwork design. The Rockwork Contractor shall be responsible to design structural reinforcement for all work in this section and shall provide a licensed structural engineer seal within project site jurisdiction certifying all structural reinforcement sections at no additional cost to the owner. Alternative methods may be recommended for greater cost efficiency. Rockwork shown on the drawings is for "order of magnitude" quantity projections. Rockwork contractor is responsible for providing actual amounts needed within bid price.

- D. Methods of Construction: The Rockwork Contractor shall submit with bid proposal proposed methods of construction for all work in this section. Such documentation shall include the following:
1. Statement of understanding of the overall project schedule and required completion of all rockwork and artifacts.
 2. Submit a detailed description of proposed fabrication and finish techniques (including materials) for artificial geology and alternate structural systems (if applicable). Exhibit Contractor is responsible for effective waterproofing of all water features including but not limited to all rockwork interfacing with drains, skimmers, walls, etc.
 3. Recommend additional cost-effective alternative methods of construction prior to start of work for consideration by Architect and Owner.
- E. Excavation, Subdrainage and Backfill:
1. The Rockwork Contractor is responsible for the dewatering, shoring and maintenance of all excavation, subdrainage, wall drainage and aggregate for shotcrete features up to the shotcrete subgrade.
 2. It is the Rockwork Contractor's responsibility to coordinate with the General Contractor to facilitate excavation as close to final subgrade as possible.
 3. The Rockwork Contractor must accept the subgrade in written form for each individual exhibit or portion of an exhibit and submit to the Owner's Representative for approval. If not accepted, the Rockwork Contractor must notify the Owner's Representative in writing immediately.
 4. Following the acceptance of the subgrade by the Rockwork Contractor and approval by the Owner's Representative, the Rockwork Contractor shall be responsible for the following at no additional cost to the Owner:
 - a. All additional subgrade adjustment and reinstallation of drainage systems and sleeves required for his work.
 - b. All maintenance required to maintain the accepted subgrade, with the exception of any dewatering device which shall be the responsibility of the Site Contractor.
 5. All backfill behind, around, within and on top of the shotcrete features to complete the rock simulation work to the satisfaction of the Architect shall be the responsibility of the Site Contractor in coordination with the Rockwork Contractor.
 6. Soil survey is available for reference and is not considered a part of the contract documents.

1.11 PROJECT SITE CONDITIONS

- A. Protection of Property: Take note of requirements for protection of trees and soils as specified. In particular, do not discharge cement bearing water onto the ground on site except as specifically approved by the Owner's Representative. Account for all debris generated by operations and remove from site regularly, especially small bits of reinforcement and hardware.
- B. Surveying:
1. Provide surveying as frequently as is required to accurately locate features as detailed on drawings. Confirm location, elevations and profiles of work by optical or laser survey immediately before and after placement of each contiguous surface.
 2. Tolerance for location of any point defined on the drawings in one tenth of one foot in both horizontal and vertical dimensions.

C. Protection:

1. Be responsible for protection of project materials, including waterproofing susceptible to damage during forming, placing or reinforcement of shotcrete. Provide masks or remove damageable materials before beginning work.

1.12 ARCHITECT/EXHIBIT DESIGNER'S DIRECTION

- A. It is intended that the configuration, texturing and coloring for exposed shotcrete be executed under the detailed direction of the Architect/Exhibit Designer, at least until such time as satisfactory examples of the desired character have been developed. Notify the Owner's Representative at least forty-eight hours before beginning placement of first example of each type of shotcrete to be exposed and schedule time when the Architect/Exhibit Designer can observe and direct the finishing work as it is executed.

1.13 ANIMAL ESCAPE CONCERNS

- A. It is the Rockwork Contractor's responsibility under the direction of the Zoo and Owner's Representative to ensure that the finished work is completed in a way to not pose an animal escape hazard, to the satisfaction of the Owner.

1.14 TESTING SERVICE

- A. Owner will contract and pay for testing services. Rockwork Contractor shall cooperate and coordinate testing with Owner provided testing service.

1.15 WARRANTY

- A. Warranty work in this section for one year from date of Final Acceptance.
- B. Provide a 5-year manufacturer's limited material warranty for the crystalline waterproofing admixture.
- C. Repair or replace materials if there is a failure to perform as required due to failures of materials or workmanship.

1.16 PRICES

- A. Contractor will provide unit prices as required in Division 00 documents for all rockwork types to be used in change orders (if required).
- B. Waste, Rebound and Extra Material Required for Realistic Natural Simulations: Past experience in similar zoo projects indicates that up to 35% extra concrete material (above what appears on the drawings) is or may be required to create realistic, natural simulations of the items to be provided. All bids should reflect this extra material and labor for application.
- C. Bids shall include cost of all subsurface footings and other requirements needed to complete the work.

PART 2 - PRODUCTS

2.1 ARTIFICIAL ROCKWORK (SHOTCRETE) MATERIALS

A. Reinforcing Materials:

1. Refer to Division 03 Section "Shotcrete" for requirements.

B. Concrete Materials

1. Refer to Division 03 Section "Shotcrete" for further concrete mix design requirements.
2. Waterproofing:
 - a. Rockwork at pools and beaches, shall include a crystalline waterproofing admixture mixed with concrete mix.
 - 1) Subject to compliance with requirements, provide one of the following:
 - a) AQUAFIN, Inc: with retarder Aquafin®-IC ADMIX-Powder or without retarder IC-ADMIX-Powder-NR505. Blue Ball Rd., #160, Elkton, MD, 21921 Phone (800) 394-1410 or (410) 392-2300, Fax (410) 392-2324; e-mail info@aquafin.net.
 - b) Xypex Chemical Corporation: Xypex Admix C-500, C-1000 or C-2000. 13731 Mayfield Place, Richmond, B.C., Canada V6V 2G9. Phone: (800) 961-4477 or (604) 273-5265; Fax: (604) 270-0451; e-mail info@xypex.com, website www.xypex.com.
 - 2) Or approved equal.
 - 3) Admix must be added to concrete mix at time of batching at manufacturer's recommended rates.
 - b. Pools and Streams: In addition to the integral waterproofing (item "a" above), additional waterproofing shall be provided for all pool and rock surfaces underwater and to one foot above pool waterline. This waterproofing shall be integrated into the shotcrete and shall consist of the following 3 parts that, when combined, act as a shotcrete/waterproofing system:
 - 1) Structural shotcrete coat with all structural reinforcing.
 - 2) Cementitious emulsion-based flexible waterproofing applied to structural coat. Use of the following:
 - a) Refer to Division 07 Section "Polymer Modified Cement Waterproofing" for approved product.
 - 3) Finish shotcrete coat applied to the cementitious emulsion-based waterproofing.
 - c. Raised Planters: Shotcrete planters over occupied spaces or have CIP concrete or unit masonry forming one or more sides of the planter shall receive the Polymer Modified Cement Waterproofing system on all surfaces directly adjacent to the soil and substrates filling the planter.
3. Color Additives: Pure Mineral Oxides.

- a. Frank B. Davis Company, Williams or approved equal.
- 4. Expansion Material: Closed cell pre-molded expansion joint filler.
- 5. Cetco Waterstop RX and Bentonite Butyl rubber waterstop by Cetco. Waterstop RX or approved equal at all joints and seams to 12" above water level.
- 6. Moisture Retaining Cover: Burlap: Cloth made from jute and weighing approximately 9 oz. per sq. yard for moist curing and conforming to AASHTO M 182.
- 7. Liquid Membrane-Forming Curing Compounds conforming to ASTM C 309.

2.2 EXHIBIT ARTIFACT AND MISCELLANEOUS MATERIAL

- A. Paint shall be acrylic latex, highest quality exterior grade, matte finish.
- B. Drains and Weeps: As indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Scope:
- B. Coordinate excavation and backfill with site grading contractor, allowing for use of earth face as backform where appropriate. Maintain earth grades and shapes once shotcrete work has commenced.
 - 1. Coordinate exhibit construction in a pre-scheduled manner to allow proper access and operation with other trades.
 - 2. Cooperate with Architect and respond to directions for the purpose of achieving the artistic effects illustrated by the contract documents and reference photos.
 - 3. Coordinate and install exhibit elements required by this and other Sections required for a complete installation as detailed on the Drawings.
 - 4. Finish, color and detail shotcrete construction with skill and sensitivity for the exhibit purposes, the character of the simulated landscape and the care of the animals.

3.2 TESTING REQUIREMENTS

- A. Refer to testing requirements as required in Division 03 Section "Shotcrete".

3.3 PLACEMENT OF EXHIBIT FEATURES

- A. Layout: All items shall be placed at location on the site and grades shown on the Drawings and as directed by the Architect.

3.4 FORMING SHOTCRETE STRUCTURES

- A. At structural pool slabs, side walls, shoring and bracing wall and background concrete walls, where artificial rockwork is to be constructed, use the backup construction described below or provide the Architect/Exhibit Designer with an alternate construction system for approval.

1. Construct an armature of metal lath on the unexposed side of the shotcrete structure as the backup construction material behind the steel reinforcing bars to which the shotcrete is applied.
 2. Metal lath shall be bent to conform approximately to the welded steel reinforcing frame and shall be held away from the nearest bars a minimum distance of 2" min. In order to facilitate the installation of metal lath the contractor may increase the thickness of the shotcrete to do away with matching exactly the steel reinforcing outline. However, all variances from the steel outline must be approved by the Exhibit Designer.
 3. Metal lath shall be fastened to the reinforcing bars by means of tie wires or anchor spacers. Ties or spaces shall be spaced not more than 10" on center in all directions. Space lath away from reinforcing rods such that reinforcing rods will be in the center of the finished structure. There must be a 2" minimum thickness of concrete between reinforcing bars and lath.
- B. Wherever a flash coat is to be applied to a concrete surface, the concrete surface shall be roughened texture with minimum 2" thickness. Test cores shall be taken to verify.
- C. The finish form, color and texture of the finish surface must meet with the approval and be completed to the satisfaction of the Exhibit Designer, which approval, when given, must be in writing. Contractor shall bear all costs of any and all work required to secure such approval.

3.5 PROVISIONS FOR OTHER TRADES

- A. The Rockwork Contractor shall be responsible for coordinating of all other trades (within this bid and subsequent bids) in contact with their work and Owner supplied items to fully complete the habitat setting.
- B. Provide sleeved openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, drains, cavities, and chases from trades providing such items. All non-sleeved piping shall be set by the appropriate contractor except that sleeves shall be provided by the appropriate contractor and installed by the Rockwork Contractor. Accurately place and securely support items built into forms.
- C. Provide engineering where required and coordinate shotcrete installation for woven mesh cable anchors in Shotcrete. Coordinate rockwork installation with animal barrier systems as indicated on the drawings and as directed by Owner's Representative in the field.

3.6 STEEL REINFORCEMENT

- A. Reinforcing sizes: The Rockwork Contractor shall develop reinforcement sizing and placement to facilitate his/her work. All structural calculations for reinforcement must be fully and clearly documented by a registered professional structural engineer, licensed in the local project jurisdiction.
- B. General:
1. Clean reinforcement of loose rust, mill scale, earth, ice, and other materials which reduce bond with concrete.
 2. Accurately position, support and secure reinforcement against displacement by construction or concrete placement operation. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
 3. Notify Owner's Representative upon completion of reinforcing and prior to placing shotcrete for review and sign-off of form/massing.

- C. Minimum Standards: The following minimal steel placement standards are supplemental to the steel reinforcement notes shown on the drawings and Division 03 Section – “Shotcrete”. Follow Shotcrete specifications if any discrepancies arise and immediately bring to Architect’s attention.
1. No. 3 reinforcing bars shall be placed on 12” centers both ways as the minimum acceptable amount of bar reinforcing and shall be continuous around corners. The spacing shall remain the same but the bar size will increase where, in the opinion of the Engineer, it is deemed necessary. A No. 4 bar acting as a key rod shall be placed at intersections of all plan surfaces.
 2. Tack weld or wire bars where they contact or cross each other. The bars must form a rigid framework. All bars are to lap thirty (30) diameters at splices. However, a lap of 4” will be allowed if one continuous fillet weld of 3” in length is used to tie or weld the bars together at the splice. All welding to be in accordance with Division 05 Section - “Structural Steel Framing”. Touch up bars at welds.
 3. Reinforcing bars shall be placed and bent around circles and curves, openings, corners, and angles to conform with the drawings. Bends are to be permanently shaped, not sprung into place. Particular attention shall be made to follow the outline of the stratified rock formations to eliminate excess non-reinforced rockwork outcroppings
 4. The tie bars and tie anchors which are exposed to air and which do NOT come in contact with any backfill material shall be given a protective covering of asphalt coating of at least one heavy coat or Rustoleum, or equal.
 5. Tie bars and tie anchors which come in contact with backfill material shall be encased with a coating of shotcrete. Steel shall be covered by a minimum of 1” of shotcrete.
 6. Additional #4 bars shall be used diagonally across corners of all openings, and wherever shotcrete formations act as beams additional #5 bars shall be placed at points of maximum stress, i.e., one in top and one in bottom extending 12” into supports. Additional #4 bars shall be integrated into the steel framework if such steel is necessary to provide a stable structure.
 7. The mesh shall be placed on steel reinforcing on side opposite the backup material and shall be securely wired to the reinforcing bars at not less than 20” intervals in both directions. Mesh shall lap at least 2” at adjacent ends.
 8. Place reinforcing for pools and slabs uniformly 1 ½” to 2” from the bottom of shotcrete slabs.

3.7 MIXING CONCRETE

- A. Mix concrete to obtain the compressive strengths identified in Division 03 Section “Shotcrete.”
- B. Mix integral color into the concrete mix to the recommendations of the color manufacturer and requirements of mix design.

3.8 PLACING CONCRETE

- A. All shotcrete shall be placed to a minimum thickness of 6”, unless otherwise noted.
- B. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.
- C. Maintain reinforcing in the proper position during concrete placement operations.
- D. Rebound: All rebound or accumulated loose aggregate shall be removed from the surface to be covered prior to placing the initial or any succeeding layers of pneumatically placed concrete.

Rebound may be re used if it conforms to the requirements for aggregate, but not in excess of 25% of the total aggregate in any batch.

E. Joints:

1. Unfinished work shall not be allowed to stand for more than 30 minutes unless all abrupt edges are tapered to a thin edge. Before resuming work, this sloped portion shall be cleaned, and a bonding agent applied.
2. All construction joints in shotcrete rocks shall be tapered off to an edge. Before shooting the adjacent section, the sloped portion shall be thoroughly cleaned and wetted with compressed air and water blast. No square joints will be permitted. All construction joint locations must be so positioned as to conform to the natural rock appearance as shown on the models.
3. Construction joints in either pool walls or slabs will be squared off with a 2" x 4" key and waterstop.
4. Expansion joints in either pool walls or slabs will be squared off with a 2" x 4" key, waterstop, pre-molded joint filler and caulked.

F. Damage: All pneumatically placed concrete which subsides after placement shall be removed.

3.9 WATERPROOFING INSTALLATION

A. Comply with manufacturer's dosing, mixing and installation requirements for all waterproofing systems.

B. Crystalline Waterproofing:

1. Setting time and Strength: Some retardation of set may occur when using Crystalline Waterproofing Admix products. The amount of retardation will depend upon the concrete mix design, the particular Admix product used, dosage rate of the Admix, temperature of the concrete and climatic conditions. Concrete containing an Admix product may develop higher ultimate strengths than plain concrete. Conduct trial mixes under project conditions to determine setting time and strength of the concrete. Consult with manufacturer or manufacturer's representative regarding concrete mix design, project conditions and proper dosage rate.
2. Crystalline waterproofing admixture shall be added to the concrete at the time of batching at a concrete plant or to the finished mix in the ready-mix truck at the job site. The sequence of procedure for addition will vary according to the type of batch plant operation and equipment.
3. Do not add bulk (bag) dry powder crystalline waterproofing admix to wet concrete mix. This may cause clumping of the admix and uniform dispersion cannot be guaranteed. Mix with water first, before adding to wet concrete.
4. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of concrete batching and product installation in accordance with manufacturer's instructions.

C. Polymer Modified Waterproofing:

1. Apply waterproofing material in quantities by manufacturer's specified recommendations. The following minimal standards are supplemental to manufacturer's recommendations found in Division 07 waterproofing sections. Request clarification from exhibit designer on any discrepancies.
 - a. Apply at 90 mils thickness.
 - b. Apply, using stainless steel trowel, fampico brush, or appropriate compressed-air spray equipment.

- c. Waterproofing material can be applied on walls in one coat by trowel or spraying up to 1/8" thickness provided the surface is immediately covered by a protection fabric, supplied by the waterproofing manufacturer.
- d. If needed, such as in zones posed to movement or cracking, the waterproofing material can be additionally reinforced with a reinforcing mesh (supplied by waterproofing manufacturer), embedded between two waterproofing layers.
- e. Apply only when surface and ambient temperatures are 40 - 45 degrees F. and rising. At high temperatures (i.e. 90 degrees F and above) protect application from direct sun and wind to prevent premature surface shrinkage. Apply material in two coats minimum. Apply second coat within one hour.
- f. Application thickness should not exceed 1/8".
- g. Do not bridge cracks greater than 1/16".
- h. Bridge dynamic cracks or joints with elastomeric joint sealing tape, as supplied by waterproofing manufacturer.
- i. Do not overcoat waterproofing material with solvent-based materials.
- j. Curing: Follow manufacturer's general instructions for curing and hardening of waterproofing material and protect surfaces from rain, frost and drying out.

3.10 FINISHES

- A. The Rockwork Contractor shall provide experts to complete the desired finishing for all work to receive a natural appearance. Such finishing and coloring shall cover all surfaces exposed to public viewing and extend at least 12" beyond view or below final backfill or grading. Architect to provide color samples as a point of beginning for painting work.
- B. Carved Rockwork Formations: Artificially constructed geology and sedimentary geologic formations, as illustrated on the drawings and photographs.
- C. Detailed carving, textures and colors on pools and streams should be carried to a minimum of four (4) feet below water level, unless otherwise noted. Finishes below this depth to be as directed by Architect.

3.11 CURING SHOTCRETE CONCRETE

- A. Cover and cure Shotcrete concrete as described in Division 03 Section- "Shotcrete", taking special care not to disturb special textures achieved for this work.

3.12 POOLS AND STREAMS TESTS

- A. All Pools and Streams shall be filled to capacity prior to installing any finishes. Water must hold a stable level at predetermined static water level for 48 hours. If the test is positive, finishes may be applied if the test is negative, locate and repair the leak and retest until the test is positive.
- B. Tests shall be as follows:
 - 1. 48-Hour Test Procedure: All Pools and Streams will be filled to capacity following structural coat and application of waterproofing. Perform a pool bucket test for 48 hours. The amount of water loss due to evaporation should be similar in the bucket and pool. Water must hold a stable level at predetermined static water level for 48 hours. If the test is acceptable to the Owner and Architect, the application of the shotcrete carving coat and subsequent finishes may be applied. If the test is negative, locate and repair the leak and retest until the test is positive.

2. 2-Week Test Procedure: After all shotcrete, finishes and equipment are applied and installed each pool and stream shall be tested for leaks while the recirculation equipment is on, for a continuous time period of 2-weeks. A constant water level must be maintained during this time period. If water levels drop, locate the source of the leak, and repair as required. Retest for an additional 48-hour period with equipment turned on. Retest for 48 hours each time until the test is positive.

3.13 INSTALLATION OF ARTIFACTS AND OTHER ITEMS

- A. Install deadfall and boulders as shown on the plans.

3.14 PAINTING

- A. Paint all exposed surfaces of shotcrete. Painting shall make exhibit artifacts look as natural as possible, using provided references photos. Exhibit Designer shall be final judge of acceptable quality of painting.
- B. In order to blend in with surrounding artificial rockwork, additional items in and around shotcrete such as, miscellaneous hardware, and concrete walls, etc., are to receive matching paint finishes in order to achieve an overall uniform look.
- C. Rockwork items to be painted, including theme painted concrete and boulders, and miscellaneous items should have a minimum of three different paint colors.

3.15 NATURAL BOULDERS

- A. Excavate as needed, place and backfill natural boulders as specified, and as directed and located by the Owner/Architect/Exhibit Designers. Boulders to be theme painted to blend in with exterior historic elements and match surrounding rockwork.

3.16 CLEAN-UP

- A. Clean-up rebound from operations and dispose of as void fill, as structural fill more than 3' – 0" below finish grade, or off-site on a daily basis.
- B. Do not leave or bury loose pieces of reinforcing, sheet or expanded metal, tie wire, plastics or any other material not fully-embedded in concrete.
- C. Clean overspray and rebound from adjacent work (including natural boulders) at the completion of each day's placing (or sooner if required). Leave all surfaces broom-clean and unstained at the completion of the work.

3.17 FINAL COMPLETION

- A. Contractor shall repair and patch all punchlist items to the satisfaction of the Architect.
- B. Contractor shall carefully inspect all construction areas to remove all debris, particularly stones, steel bars, and other materials, which could be uncovered by the Animals.

3.18 INSTRUCTIONS ON OPERATIONS AND MAINTENANCE

- A. Schedule an on-site instructional seminar with all required Zoo personnel. Instruct for the operations, proper usage, and maintenance of all items installed.

3.19 SCHEDULE OF IMAGES

- A. The Exhibit Rockwork Theming and Image Book (included next section) identifies images for the rockwork and rockwork type adjacencies in order to give the contractor the intent of the design. These should be used as a guide for the form, texturing and transition of rockwork types. Additional images can be provided for further clarification during construction.

END OF SECTION 03 37 12

SECTION 03 37 12.01

EXHIBIT ROCKWORK THEMING & IMAGE BOOK



Example of the Komodo pool and mudbanks. Note mud color and texture.



Example of Komodo exhibit boulders color and texture. Komodo dragon basking rocks to be similar to boulders in foreground – flat, shallow slope, and low to the ground.



Example of interior Komodo dragon mudbank planter texture and form with an overhang at the top and some eroded material at the base.



Example of erosion rills and gullies. A few smaller scale rills, similar to areas circled in red, to be worked into the indoor Komodo dragon mudbank planter.



Geology from the Aldabra Atoll. Example of color, form and texture at edges of indoor and outdoor Aldabra Tortoise pools.



Geology from the Aldabra Atoll. Note color, form, and texture.



Precedence for raised planter geology adjacent to the interior Aldabra pool.
Note forms, texture, and color.

SECTION 03 37 13

SHOTCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Shotcrete applied by wet-mix process.
- B. Related Requirements: Note: Some sections referenced below will be issued with the final bid package scope.
 - 1. Division 03 Section "Exhibit Rockwork" for further shotcrete/rockwork requirements, integral crystalline waterproofing and waterstops used in conjunction with shotcrete.
 - 2. Division 07 Section "Polymer Modified Cement Waterproofing" for flexible, waterproofing added to structural shotcrete.

1.3 DEFINITIONS

- A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
- B. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. See Division 03 Section "Exhibit Rockwork".

1.5 ACTION SUBMITTALS

- A. See Division 03 Section "Exhibit Rockwork" for additional information
- B. Product Data: For each type of product including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
- C. Design Mixtures: For each shotcrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Shop Drawings: For shotcrete installation. Include support and anchor details; reinforcement materials and grades and details of fabricating, bending, and placing reinforcement; number and location of splices; special reinforcement required for openings through shotcrete

structures; formwork materials and details of formwork fabrication, assembly, and support; and locations of proposed construction joints.

- E. Samples: For each exposed product and for each color and finish specified. See Division 03 Section "Exhibit Rockwork".

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Material Certificates: For each of the following:
 - 1. Cementitious materials.
 - 2. Admixtures.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer employing nozzle operators for the Project, each of whom is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical and Overhead Positions as appropriate to the required shotcrete work. See Division 03 Section "Exhibit Rockwork."
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. ACI Publications: Comply with ACI 506.2, "Specification for Shotcrete," unless modified by requirements in the Contract Documents.
- D. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for each finish required and for each design mixture, shooting orientation, and nozzle operator.
 - 2. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 3. Demonstrate curing and protecting of shotcrete, finishes, and joints, as applicable.
 - 4. In presence of Architect, damage part of the exposed-face surface for each color and finish, and demonstrate materials and techniques proposed for repair of holes and surface blemishes to match adjacent undamaged surfaces.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

- B. Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire, furnished in flat sheet.
- C. Mesh Screening (wire cloth): Galvanized, unpainted, 2" x 2" x 14 gauge. Square mesh, plain weave.
- D. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice."
- E. Metal Lath: ASTM-F 1267 galvanized, unpainted.
 - 1. Type 1 – Expanded – 1/2".
 - 2. Class 2 – Grade 'A' coating designation (.00025 in mm coating).

2.2 SHOTCRETE MATERIALS

- A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.
- B. Portland Cement: ASTM C 150, Type I or Type III. Use only one brand and type of cement for Project.
- C. Normal-Weight Aggregates: ASTM C 33, from a single source.
- D. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored, water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.
- E. Water: Potable, complying with ASTM C 94/C, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
- F. Refer to Division 03 Section "Exhibit Rockwork" for more information and waterproofing.

2.3 ADMIXTURES

- A. General: ASTM C 1141, Class A (liquid) or Class B (non-liquid) but limited to the following admixture materials. Provide admixtures for shotcrete that contain no more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
 - 1. Coloring Admixture: Coloring agent as limited in "Shotcrete Materials" Article.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry, or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.5 SHOTCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs-based laboratory trial mixture or field test data, or both.
- B. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
- C. Admixtures: When included in shotcrete design mixtures, use admixtures according to manufacturer's written instructions.
- D. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.6 SHOTCRETE MIXTURES

- A. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having air content before pumping of 7 percent with a tolerance of plus or minus 1-1/2 percent.
 - 3. Color: As selected by Architect to match reference images.

2.7 SHOTCRETE EQUIPMENT

- A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
- B. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.8 BATCHING AND MIXING

- A. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94/C and furnish batch ticket information.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Concrete or Masonry: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2-inch-deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.
- B. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces to saturated, surface-dry condition before shotcreting.

3.2 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.
- D. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.
- E. Install welded wire reinforcement in longest practical lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.3 JOINTS

- A. General: Construct joints at locations indicated or as approved by Architect.
- B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.
- C. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch-wide by 1/3 slab depth or joint-filler strips 1/4-inch-wide by 1/3 shotcrete depth unless otherwise indicated.
 1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
 2. Space joints horizontally and vertically.
 3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
 4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.
- D. Minimum 3" of rebar cover for any shotcrete in contact with salt water.

3.4 EMBEDDED ITEMS

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

- B. See Division 03 Section "Exhibit Rockwork".
- C. Embeds shall be galvanized typical, SS where in contact with salt water.

3.5 APPLICATION

- A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.
- B. Apply shotcrete according to ACI 506.2.
- C. Apply wet-mix shotcrete materials within 90 minutes after batching.
- D. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
 - 1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
- E. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray and prevent buildup against front face during shotcreting.
- F. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.
- G. Do not permit shotcrete to sag, slough, or dislodge.
- H. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
- I. Do not disturb shotcrete surfaces before beginning finishing operations.
- J. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
- K. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117, increased by a factor of two.
- L. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. Discontinue shotcreting when ambient temperature is 40 deg F and falling.
 - 2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F and not more than 90 deg F.
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
 - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- M. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to recommendations of ACI 305.1 when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
 - 1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 90 deg F for wet mix.

2. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F before shotcreting.

3.6 SURFACE FINISHES

- A. General: Finish shotcrete according to descriptions in ACI 506R.
- B. Finish-Coat with Final Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply shotcrete finish coat, 1/4 to 1 inch thick, using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 sieve, and apply finish.

3.7 CURING

- A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
- B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.
- C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
 1. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Apply curing compound to natural gun finish or flash-coat shotcrete at rate of 1 gal./100 sq. ft.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.
- B. Air Content: ASTM C 173/C, volumetric method or ASTM C 231, pressure method; one test for each compressive-strength test for each mixture of air-entrained, wet-mix shotcrete measured before pumping.
- C. Shotcrete Temperature: ASTM C 1064/C; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
- D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mixture and for each workday or for every 50-cu. yd. of shotcrete placed, whichever is less. Coordinate with mockup list specified under spec section 033712 "Exhibit Rockwork". Produce test panels with dimensions of 24 by 24 inches minimum and of average thickness of shotcrete, but not less than 4 ½ inches. Testing agency will obtain sets of test specimens from each test panel.
 1. Compressive Strength Testing: One set of three unreinforced specimens. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.

2. Visual Core Grading: One set of three reinforced specimens. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.
- E. In-Place Shotcrete Testing: One set of three unreinforced cores for each mixture and for each workday or for every 50-cu. yd. of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement.
- F. Strength of shotcrete will be considered satisfactory according to the following:
 1. Specimen Cores: Mean compressive strength of each set of three unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
 2. Specimen Cubes: Mean compressive strength of each set of three unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

3.9 REPAIRS

- A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.
 1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.
 2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2-inch-deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
 3. Dampen surfaces and apply new shotcrete. Match adjacent color and finish.
- B. Repair core holes from in-place testing according to repair provisions in ACI 301, except do not use shotcrete. Match adjacent color and finish.

3.10 CLEANING

- A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 03 37 13

SECTION 03 4500

PRECAST ARCHITECTURAL 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Architectural precast concrete miscellaneous trim units.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.
 - 2. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
 - 3. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, provide the following information when available:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- D. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate details at building corners.

5. Indicate separate face and backup mixture locations and thicknesses.
 6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 9. Include plans and elevations showing unit location and sequence of erection for special conditions.
 10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 11. Indicate relationship of architectural precast concrete units to adjacent materials.
 12. 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.
- E. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
- F. Delegated-Design Submittal: For architectural precast concrete 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. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and testing agency.
- B. Welding certificates.
- C. Material Certificates: For the following items:
1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Structural-steel shapes and hollow structural sections.
 6. Insulation.
- D. Material Test Reports: For aggregates.
- E. Preconstruction test reports.
- F. Source quality-control test reports.
- G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.
- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or designated as an APA-certified plant for production of architectural precast concrete products.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- F. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 sq. ft. in area for review by Architect. 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 acceptance of repair technique, maintain one sample panel at manufacturer'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.
- G. Mockups: After sample panel and range sample approval but before production of architectural precast concrete units, 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.
 - 1. Provide Mock-up Panel as indicated on drawings.
 - a. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.
- B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated.
 - 2. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 3/4 inch.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true 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. Use 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 final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, with ASTM A 767/A 767M, Class II zinc coating and chromate treatment. Galvanize after fabrication and bending.
- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- F. 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 117.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C 618, Class N.
 - 3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, 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.

- D. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 - 9. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M.

2.5 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy Group 1 or 2 hex-head bolts and studs; ASTM F 594, Alloy Group 1 or 2 stainless-steel nuts; and flat, stainless-steel washers.
 - 1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
- C. Stainless-Steel-Headed Studs: ASTM A 276, Alloy 304 or Alloy 316, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.6 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
 - 1. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 2. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
 - 3. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 - 4. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.7 ACCESSORIES

- A. Reglets: Stainless steel, Type 302 or Type 304, felt or fiber filled, or with face opening of slots covered.
- B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide Duragrout by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use a single design mixture for units with more than one major face or edge exposed.
 - 2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- E. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

- H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

- A. 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."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 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.
 - 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 strands to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches 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 reinforcement 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.

- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. 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.
- I. 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.
- J. Thoroughly consolidate placed concrete by internal and external 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 117.
 - 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.
- K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure 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.
- N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/8 inch.
 - b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
 - c. 20 to 40 feet, plus or minus 1/4 inch.
 - d. Each additional 10 feet, plus or minus 1/16 inch.
 - 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/4 inch.
 - b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.

- c. 20 to 40 feet, plus or minus 3/8 inch.
 - d. Each additional 10 feet, plus or minus 1/8 inch.
 - 3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
 - 4. Rib Thickness: Plus or minus 1/8 inch.
 - 5. Rib to Edge of Flange: Plus or minus 1/8 inch.
 - 6. Distance between Ribs: Plus or minus 1/8 inch.
 - 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
 - 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
 - 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
 - 10. Dimensions of Haunches: Plus or minus 1/4 inch.
 - 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
 - 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
 - 13. Bowing: Plus or minus L/360, maximum 1 inch.
 - 14. Local Smoothness: 1/4 inch/10 feet.
 - 15. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
 - 16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
 - 17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
- 1. Weld Plates: Plus or minus 1 inch.
 - 2. Inserts: Plus or minus 1/2 inch.
 - 3. Handling Devices: Plus or minus 3 inches.
 - 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
 - 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
 - 6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
 - 7. Location of Rustication Joints: Plus or minus 1/8 inch.
 - 8. Location of Opening within Panel: Plus or minus 1/4 inch.
 - 9. Location of Flashing Reglets: Plus or minus 1/4 inch.
 - 10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
 - 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
 - 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
 - 13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
 - 14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
 - 15. Position of Sleeve: Plus or minus 1/2 inch.

2.13 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:
- 1. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 - 2. Color: Buff to match Indiana Limestone.
- B. Finish exposed top and back surfaces of architectural precast concrete units with smooth, steel-trowel finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.14 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.
- B. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- C. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318.
 - 1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 - 2. Test cores in an air-dry 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 concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. 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 concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- E. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete 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. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast 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.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 - 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 - 3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.
- F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
 - d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 - 6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 - 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
 - 9. Maximum Joint Taper: 3/8 inch.
 - 10. Joint Taper in 10 Feet: 1/4 inch.
 - 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
 - 13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of loadbearing precast concrete members.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- 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 feet.

- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. 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 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.

END OF SECTION

SECTION 03 5416

CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Portland cement-based, polymer modified structural repair mortar with integral corrosion inhibitor.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 REPAIR MORTAR

- A. Single-component, polymer-modified, Portland cement-based structural repair mortar, with integral corrosion inhibitors suitable for exterior and interior horizontal applications above, on or below grade.
 - 1. Acceptable Products:
 - 2. ARDEX B 24™; Manufactured by ARDEX Americas: 400 Ardex Park Drive, Aliquippa, Pa 15001 USA 724-203-5000
 - 3. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F (23° C) and 50 percent relative humidity:
 - 4. Application: Trowel.
 - 5. Working Time: 25 – 45 minutes.
 - 6. Compressive Strength: 6800 psi (48.3MPa) at 7 days, 7900 psi (56.58 MPa) at 28 days, ASTM C109.
 - 7. Flexural Strength: 1000 psi (8.3 MPa) at 7 days, 1000 psi (10.3 MPa) at 28 days, ASTM C293.
 - 8. Modulus of Elasticity: 4.10 x 10⁶ psi at 28 days
 - 9. Color: Concrete gray.
- B. ARDEX EP 2000™ Substrate Preparation Primer
- C. ARDEX BONDING & ANTI-CORROSION AGENT
- D. WATER: Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare substrate in accordance with manufacturer's instructions. Prior to proceeding with any repair, please refer to the International Concrete Repair Institute's ICRI 03730 Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion; ICRI 03732 Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays; and the American Concrete Institute's ACI 546R-04 Concrete Repair Guide for general guidelines for concrete repair.
 - 1. All concrete and masonry substrates must be sound, solid, dry, and completely free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker. Overwatered, frozen or otherwise weak concrete surfaces must also be cleaned down to sound, solid concrete by mechanical methods such as scarifying, scabbling or similar in accordance with ICRI 03732 before priming. Acid etching and the use of sweeping compounds and solvents are not acceptable.
 - 2. The repair area must be saw cut in a basic rectangular shape at least ¼" (6 mm) in depth. The cuts should be made at 90° angle, and should be slightly keyed. Chip out the concrete inside the cuts to a minimum depth of ¼" (6 mm) until the area is squared or box shape.
 - 3. Mechanically prepare surface to obtain an exposed aggregate surface with a minimum surface profile of approximately 1/16" (1.5 mm).

4. For cases with exposed reinforcing steel, mechanically clean the steel to remove all rust and any other contaminants in accordance with ICRI 03730. Prime the steel with ARDEX Bonding & Anti-Corrosion Agent™ prior to proceeding with repair.

B. Joint Preparation

1. Moving Joints and Cracks – honor all expansion and isolation joints up through the ARDEX B 24™. A flexible sealing compound suitable for the application may be installed. ARDEX ARDISEAL™ RAPID PLUS may be installed for interior applications only.
2. Control Joints and dormant cracks greater than 1/16" – fill all non-moving joints and cracks with ARDEX ARDIFIX™ Joint Filler.

3.3 APPLICATION OF ARDEX B 24™:

- A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing and handling of materials.
- C. Prepared concrete must be primed for bonded application of ARDEX B 24. For priming with ARDEX BACA or ARDEX EP 2000, follow the application instructions in the appropriate ARDEX technical data sheet. Please note that ARDEX BACA is suitable for a surface primer only. If ARDEX BACA is not used, use water to dampen the concrete until it is saturated thoroughly. When water is used, the goal is to saturate the pores of the concrete while leaving the surface free of liquid (SSD, Saturated Surface Dry). While the surface of the concrete must be dry and free of puddles, the pores of the concrete must be saturated with water. Installing the ARDEX B 24 over concrete that is dry can result in cracking and bond failure. Do not leave any bare spots. Brush or vacuum off puddles and excess liquid before installing.
- D. Mixing: Comply with manufacturer's printed instructions.
- E. Application: Comply with manufacturer's printed instructions.
 1. Do not apply in freezing conditions or during precipitation.
 2. Comply with manufacturer's guides for hot and cold weather application.
 3. Dampen substrate to fill concrete pores with water. Remove ponding, glistening, or surface water (saturated surface dry).
 4. Apply scrub coat of repair mortar into substrate to ensure intimate contact and establish bond.
 5. Apply ARDEX B 24™ while scrub coat is wet. Consolidate and trowel to the desired finish.
 6. ARDEX B 24™ can be installed to a minimum thickness of 1/4 inch up to 4" (6 mm to 5 cm) neat or up to 8" thick with the proper addition of aggregate. Alternatively, ARDEX B 24™ can be applied in 2" (5 cm) lifts up to 8" (20 cm) without the addition of aggregate when each lift is allowed to take initial set and then scored on top prior to the application of the subsequent lift.
- F. Curing
 1. Direct sunlight or wind may cause unwanted ARDEX B 24 surface drying. Avoid installation if rain or dew is expected within 6 - 8 hours. Keep the surface of the installation damp for 48 hours (light water fogging, curing blanket or curing compound). Do not allow water to puddle. Do not use solvent-borne curing compounds. Note: If the surface is to receive a topcoat or other type of finish, use moist curing methods only.

- G. Cleaning: Remove excess material before material cures. If material has cured, remove using mechanical methods which will not damage substrate.

END OF SECTION

SECTION 04 0120

MASONRY CLEANING, REPAIR AND REPOINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Repairing Brick masonry, including replacing units.
 - 2. Repairing stone masonry, including replacing whole and partial units.
 - 3. Removing abandoned anchors.
 - 4. Painting steel uncovered during the work.
 - 5. Repointing joints with mortar.
 - 6. Repointing joints with sealant.

1.3 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi.
- B. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- C. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
- D. High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.
- E. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- F. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to cleaning masonry including, but not limited to, the following:
 - a. Verify masonry repair and repointing specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
 - c. Materials, material application, and sequencing.
 - d. Cleaning program.
 - e. Coordination with building occupants.
 - 2. Review methods and procedures related to unit masonry repair including, but not limited to, the following:

- a. Verify unit masonry repair and repointing specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Materials, material application, sequencing, tolerances, and required clearances.
- c. Quality-control program.
- d. Coordination with building occupants.

1.5 SEQUENCING AND SCHEDULING

- A. Order sand and gray portland cement for pointing mortar immediately after approval of Samples. Take delivery of and store at Project site enough quantity to complete Project.
- B. Work Sequence: Perform masonry repair and repointing work in the following sequence, which includes work specified in this and other Sections:
 1. Remove plant growth.
 2. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 3. Remove paint.
 4. Clean masonry surfaces.
 5. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 6. Repair masonry, including replacing existing masonry with new masonry materials.
 7. Rake out mortar from joints to be repointed.
 8. Point mortar and sealant joints.
 9. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
 10. Where water repellents are to be used on or near masonry work, delay application of these chemicals until after pointing and cleaning.
- C. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to "Masonry Unit Patching" Article. Patch holes in mortar joints according to "Repointing Masonry" Article.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
 3. Include test data substantiating that products comply with requirements.
 4. For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 5. For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of replacement masonry units on the structure, showing relation of existing and new or relocated units.
 2. Show provisions for expansion joints or other sealant joints.
 3. Show provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 4. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.
- C. Samples for Initial Selection: For the following:

1. Colored Mortar and Pointing Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least six Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
 2. Sand Types Used for Mortar: Minimum 8 oz. of each in plastic screw-top jars.
 3. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
 - a. Have each set contain a close color range of at least six Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
 4. Sealant materials.
 5. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For the following:
1. Each type of masonry unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected.
 2. Each type of patching compound in the form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
 3. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
 - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
 4. Sealant materials.
 5. Accessories: Each type of accessory and miscellaneous support.
- 1.7 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For masonry repair and repointing specialist including field supervisors and workers and testing service.
 - B. Preconstruction Test Reports: For existing masonry units and mortar and replacement masonry units.
 - C. Quality-control program.
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Engage one or more chemical-cleaner, paint-remover manufacturers and sandblasting technician to perform preconstruction testing on masonry surfaces.
 1. Use test areas as indicated and representative of proposed materials and existing construction.
 2. Propose changes to materials and methods to suit Project.

1.9 QUALITY ASSURANCE

- A. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- B. Masonry Repair and Repointing Specialist Qualifications: Engage an experienced masonry unit masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.
 - 1. Field Supervision: Masonry repair and repointing specialist firm shall maintain experienced full-time supervisors on Project site during times that masonry unit masonry repair work is in progress.
 - 2. Masonry Repair Worker Qualifications: When masonry units are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products.
- C. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- D. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.
 - 1. If materials and methods other than those indicated are proposed for any phase of cleaning work, add a written description of such materials and methods, including evidence of successful use on comparable projects and demonstrations to show their effectiveness for this Project.
- E. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.
- F. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - 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.
- G. Mockups: Prepare mockups of masonry unit masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
 - 1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate

quality of materials, workmanship, and blending with existing work. Include the following as a minimum:

- a. Replacement: Four masonry unit units replaced.
- b. Patching: Three small holes at least 1 inch in diameter for each type of masonry unit indicated to be patched.
2. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required, and repoint one of the areas.
3. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on masonry units as follows:
 1. Provide test specimens as indicated and representative of proposed materials and existing construction.
 2. Replacement Masonry unit: Test each proposed type of replacement masonry unit according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 3. Existing Masonry unit: Test each type of existing masonry unit indicated for replacement according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by Architect. Take testing samples from these units.
 4. Existing Mortar: Test according to ASTM C 295/C 295M, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength.
 5. Temporary Patch: As directed by Architect, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.
- B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

- F. Handle masonry units to prevent overstressing, chipping, defacement, and other damage.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry unit masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits:
 - 1. General: Repair masonry units only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
 - 2. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least seven days after completion of cleaning.
- C. Cold-Weather Requirements: Comply with the following procedures for masonry repair unless otherwise indicated:
 - 1. When air temperature is below 40 deg F, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F.
 - 2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for seven days after repair.
- D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.
- E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8116 "Low Emitting Materials Restrictions".
- B. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- C. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions" for sealants and adhesives. Do not use adhesives that contain urea formaldehyde.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repairing masonry (brick, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.3 MASONRY MATERIALS

- A. Face Brick unit: As required to complete unit masonry repair work.
 - 1. Brick unit Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork and with physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - a. For existing that exhibits a range of colors or color variation within units, provide brick unit that proportionally matches that range and variation rather than brick unit that matches an individual color within that range.
 - 2. Special Shapes:
 - a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - c. Mechanical chopping or breaking brick unit, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.
 - 3. Tolerances as Fabricated: According to tolerance requirements in ASTM C 216, Type FBS.
- B. Stone Matching Existing: Natural building stone of variety, color, texture, grain, veining, finish, size, and shape that match existing stone and with physical properties within 10 percent of those determined from preconstruction testing of selected existing stone.
 - 1. Match existing stone on existing buildings.
 - 2. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
 - 3. Cutting New Stone: Cut each new stone so that, when it is set in final position, the rift or natural bedding planes will match the rift orientation of existing stones.

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Cement: ASTM C 1329/C 1329M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- D. Mortar Sand: ASTM C 144.
 - 1. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- E. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.

F. Water: Potable.

2.5 MANUFACTURED REPAIR MATERIALS

- A. Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
 1. Use formulation that is vapor and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than masonry units being repaired, and develops high bond strength to all types of masonry.
 2. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 3. Formulate patching compound in colors and textures to match each masonry unit being patched. Provide sufficient number of colors to enable matching of the color, texture, and variation of each unit.
- B. Cementitious Crack Filler: Ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
- C. Stone-to-Stone Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F, recommended in writing by adhesive manufacturer for type of stone repair indicated, and matching stone color.

2.6 MATERIALS

- A. Masonry Repair Anchors, Expanding Grout Sleeve Type: Fabric sleeve system with Type 304 stainless-steel tube through which system manufacturer's grout is pumped to expand the sleeve, fill cavities within wall, and bond mechanically and chemically with interior of wall construction; and complete with other devices required for installation.
- B. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units, less the required depth of pointing materials unless removed before pointing.
- C. Sealant Materials:
 1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics indicated below and according to applicable requirements in Section 079200 "Joint Sealants."
 - a. Type: Single-component, nonsag urethane sealant.
 2. Colors: Provide colors of exposed sealants to match colors of mortar adjoining installed sealant unless otherwise indicated.
 3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the No. 100 sieve.
- D. Joint-Sealant Backing:
 1. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended in writing by sealant manufacturer for preventing sealant from adhering to rigid, inflexible, joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- E. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- F. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
 1. Surface Preparation: Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" SSPC-SP 3, "Power Tool Cleaning" or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" surface preparation according to manufacturer's literature or certified statement.
- G. 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 masonry cleaners.
- 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. Minimal 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 leave residue on surfaces.

2.7 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
 1. Pointing Mortar by Volume: ASTM C 270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand. Add mortar pigments to produce mortar colors required.
 2. Rebuilding (Setting) Mortar by Volume: ASTM C 270, Proportion Specification, 1 part portland cement, 1 part lime, and 6 parts sand.

3. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

2.8 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming, alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
- C. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation, for removing paint from masonry.
- D. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint from masonry; containing no methanol or methylene chloride.
- E. Covered, Solvent-Type Paste Paint Remover: Manufacturer's standard, low-odor, covered, water-rinsable, solvent-type paste or gel formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.

2.9 CLEANING MATERIALS AND EQUIPMENT

- A. Water for Cleaning:
 1. Clean, potable, free of oils, acids, alkalis, salts and organic matter.
 2. Warm water: Between 140-180 deg F (60-82 deg C).
- B. Spray Equipment:
 1. General:
 - a. Provide spray equipment that provides controlled application of water at rates indicated for pressure measured at spray tip, and for volume. Adjust pressure, operating distance, and volume as required to ensure that cleaning methods do not damage masonry.
 - b. Equip units with pressure gages.
 2. Spray application of chemical cleaners is not permitted.
 3. For water spray application, provide fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 4. For steam application, use a steam generator capable of delivering live steam at nozzle.
 5. For heated water spray application, provide equipment capable of maintaining temperature at flow rates indicated between 140 deg F to 180 deg F (60 deg C to 82 deg C).
- C. Paint Remover: Standard formulation for removing paint from masonry.
- D. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Klean 'N Release Cleaner by Prosoco or comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers,

subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.10 COATING REMOVERS

- A. Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:
 - 1. Prosoco, Inc.
 - 2. Diedrich Technologies, Inc.
 - 3. Dumond Chemicals, Inc.
- B. Solvent paste with a mild citrus odor that contains no methylene chloride or methanol. Designed for removal of paint, graffiti and clear coatings. One application dissolves multiple coating layers for controlled removal. Formulated to reduce environmental and applicator risks associated with use of conventional chemical coating removers. Used properly, it substantially reduces the volume of waste. Potentially hazardous coating solids are trapped in the semi-dry paste, simplifying containment and disposal.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.
- C. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning 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 proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable 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 MASONRY REPAIR AND REPOINTING, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

3.3 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. Notify Architect before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
 - a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch hole where each item was removed unless directed to remove and replace masonry unit.

3.4 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Alkaline Paste Paint Remover:
 - 1. Remove loose and peeling paint using low-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply paint remover to dry, painted surface with brushes.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
 - 5. Repeat process if necessary to remove all paint.
 - 6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 - 7. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

3.5 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.
- B. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.
- C. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.
 - 1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 - 2. Remove paint and calking with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.

- b. Repeat application up to two times if needed.
- D. Working from bottom to top, prewet the surface with clean water.
- E. Apply the cleaning solution to the surface using a brush or low-pressure spray.
- F. Let the cleaner dwell on the surface 1 to 10 minutes, based on testing. Gently scrub heavily soiled areas.
- G. Working from bottom to top, rinse the surface thoroughly with clean water.
- H. Repeat steps 1 through 4 if necessary.

3.6 MASONRY UNIT REMOVAL AND REPLACEMENT

- A. At locations indicated, remove masonry units that are damaged, spalled, or deteriorated or are to be reused. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single masonry units, remove material from center of unit and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole units as possible.
 - 1. Remove mortar, loose particles, and soil from masonry units by cleaning with hand chisels, brushes, and water.
 - 2. Remove sealants by cutting close to masonry units with utility knife and cleaning with solvents.
 - 3. Store masonry units for reuse. Store off ground, on skids, and protected from weather.
 - 4. Deliver cleaned masonry units not required for reuse to Owner unless otherwise indicated.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for masonry units replacement.
- G. Replace removed damaged units with other removed units in good condition, where possible, or with new masonry units matching existing masonry units. Do not use broken units unless they can be cut to usable size.
- H. Install replacement masonry unit into bonding and coursing pattern of existing masonry unit. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - 1. Maintain joint width for replacement units to match existing joints.
 - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement masonry unit with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding masonry units that have ASTM C 67 initial rates of

absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Rake out mortar used for laying masonry unit before mortar sets according to Masonry Masonry Repointing Article. Point at same time as repointing of surrounding area.
2. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.7 PAINTING STEEL UNCOVERED DURING THE WORK

A. Notify Architect if steel is exposed during masonry removal. Where Architect determines that 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 2, "Hand Tool Cleaning" 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, notify Architect before proceeding.

3.8 MASONRY UNIT PATCHING

A. Patch the following masonry units unless another type of repair or replacement is indicated:

1. Units indicated to be patched.
2. Units with holes.
3. Units with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch in least dimension.
4. Units with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch in least dimension and more than 1/4 inch deep.

B. Remove and replace existing patches unless otherwise indicated or approved by Architect.

C. Patching Masonry units:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of masonry unit.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.

7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from masonry unit at edges, and those that do not match adjoining masonry unit in color or texture.

3.9 REPOINTING MASONRY

- A. Rake out and repoint joints to the following extent:
 1. All joints in areas indicated.
 2. Joints indicated as sealant-filled joints.
 3. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
 - c. Cracks 1/8 inch or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 1. Remove mortar from joints to depth of joint width plus 1/8 inch, but not less than 3/4 inch or not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches deep; consult Architect for direction.
 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
 1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
- F. Pointing with Sealant: Comply with Section 079200 "Joint Sealants." and as follows:
 1. After raking out, keep joints dry and free of mortar and debris.
 2. Clean and prepare joint surfaces. 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.
 - a. Install cylindrical sealant backing beneath the sealant. Where space is insufficient for cylindrical sealant backing, install bond-breaker tape.
 - b. Install sealant using only proven installation techniques that ensure that 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 masonry and matching the contour of adjoining mortar joints.
 - c. Install sealant as recommended in writing by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
 - d. Tool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant from surfaces adjacent to joint.
 - e. Sanded Joints: Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Lightly retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - f. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
- G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.10 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- C. Notify inspectors and Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
- B. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.

1.03 DEFINITIONS

- A. Retain definitions remaining after this Section has been edited.
- B. CMU(s): Concrete masonry unit(s).
- C. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops net-area compressive strengths at 28 days as indicated on Drawings
 - 1. Net-area compressive strength of masonry shall be determined from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.05 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. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units. Include material test reports substantiating compliance with requirements. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
- C. Reinforcing bar shop drawings
 - D. Joint reinforcement product data.
 - E. Anchors, ties, and metal accessories product data.
 - F. 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.
 - G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.07 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 unless modified by requirements in the Contract Documents.
- E. It is the Contractor's responsibility to engage a qualified Testing Agency for the monitoring of proportioning, mixing, and consistency of mortar and grout on-site and to provide strength testing per Section 3.08

1.08 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.

1.09 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 down both sides of walls and hold cover securely 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: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to 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.

2.02 CONCRETE MASONRY UNITS

- A. CMUs: ASTM C 90, Type N-1.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as required for project designated f'_m
- A. For $f'_m = 1500$ psi, provide a minimum 1900 psi compressive strength
- B. For $f'_m = 2000$ psi, provide a minimum 2800 psi compressive strength.
 - 2. Density Classification: Normal weight
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.03 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. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 00 "Cast-in-Place Concrete," and with reinforcing bars indicated.
- D. 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.

2.04 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
- E. Mortar Cement: ASTM C 1329.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
- G. Aggregate for Mortar: ASTM C 144.
- H. Aggregate for Grout: ASTM C 404.
 - 1. Maximum size shall be 3/8"
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with
- J. Water: Potable.
- K. Mortar and grout

2.05 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M Grade 60
- B. Horizontal Joint Reinforcement, ASTM A82
 - 1. 9-gage truss-type, galvanized.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 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. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.07 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. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. 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 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 reinforced masonry, use Type S
- 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.
 - 3. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143/C 143M.

3.01 INSTALLATION, GENERAL

- A. Provide and install temporary bracing required insuring stability of all walls during construction and until erection of attached structural framing is completed. Temporary shoring is the responsibility of the Contractor.
- 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.

3.02 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 or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch 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, or 1/2 inch 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, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch 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, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 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).

3.03 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Masonry: Unless otherwise indicated, lay exposed masonry in running bond. 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 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. Revise first paragraph below if flexible perimeter joint or thermal break is required.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. 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.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. 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. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.04 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.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

- E. Full head and bed joints shall be provided.
- F. Mortar shall be mixed onsite.
- G. Provide masonry veneer anchors at 16 inches OC set on coursing and attached to all beams, columns, partitions, and walls abutting or embedded in masonry unless noted otherwise on Architectural and Structural Drawings.

3.05 LINTELS AND BOND BEAMS

- A. Provide lintels and bond beams as indicated on Drawings
- B. Horizontal reinforcing bars in bond beams and/or lintel blocks are to be continuous and solid grouted in place and to extend not less than 20 bar diameters or 16 inches (whichever is greater) part the opening face.
- C. Bond beams are to be continuous at control joints, unless otherwise noted.

3.06 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in corners and intersections
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 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. All bars shall be tied at splices.
 - 3. 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.
 - 4. All formwork is the responsibility of the Contractor.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
 - 1. Vertical reinforcing bars may be spliced in 6ft and 8ft lengths provided that the splices in adjacent bars are staggered and arranged so that not more than 1/3 of the total number of bars are spliced at any location and not more than 1/2 of the total number of bars are spliced at mid-height of the wall.
 - 2. All bars shall be tied at splices.

3. Vertical bars shall be held in position at top and bottom and at intervals no exceeding 8ft with a minimum clearance of $\frac{1}{4}$ inch from the edge of masonry and not less than one bar diameter between bars.
 4. Bars shall lap above foundation level and between floors.
 5. Reinforcement shall be continuous from level to level.
- C. 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.
 2. Limit height of vertical grout pours to not more than 60 inches for low lift grouting
 3. If high lift grouting, provide clean-outs and adequate vibration. Max grout pour height for high lift grouting is 12 ft.
 4. All cells containing vertical reinforcing steel, lintel beams and bond beams are to be solid grouted.
 5. Grouted cell locations shall be continuous from level to level.

3.08 FIELD QUALITY CONTROL

- A. EOR may perform periodic, visual inspections in accordance with the General Notes on the Drawings. Any inspection shall not, in any way, relieve the Contractor of the final responsibility of the installation of the masonry walls with accordance with the Contract Drawings and Specifications
1. The Engineer may observe the placement of mortar, grout, and masonry units and the placement of reinforcing steel for compliance with the Contract Documents with periodic pre-pour inspection as follows with ACI 530 Quality Assurance Level B: the first pour, minimum (1) additional pre-pour inspection for subsequent pours, and (1) final prepour inspection for the top of wall.
 2. Visual Inspection is intended to provide quality control and does not alleviate the Contractor from final responsibility of installation of the masonry per drawings or guarantee the Contractor's work
 3. First course grout placement shall not occur until the EOR has performed aforementioned visual inspection.
- B. If the Engineer is not engaged or notified by the Contractor to provide Code-required periodic inspection, the Contractor shall bear the expense and responsibility of engaging a qualified third party inspector.
- C. The Testing Agency shall monitor the proportioning, mixing, and consistency of mortar and grout in accordance with ACI 530 Quality Assurance Level B.
- D. Grout Prism Compressive Testing
1. One set shall equal (3) prisms each for testing at (7) days and (28) days, plus retain (3) additional prisms for any required additional testing.
 2. One set of tests for each 3000 sq. ft. of wall area or portion thereof, but not less than (2) tests for each testing period or (1) test per day of grout placement.
 3. Build and test masonry grout prisms in accordance with ASTM C1019.
 4. Build grout prisms in the presence of the Testing Agency.
- E. Mortar Cube Testing
1. One set shall equal (3) prisms each for testing at (7) days and (28) days, plus retain (3) additional prisms for any required additional testing.

2. One set of tests for each 3000 sq. ft. of wall area or portion thereof, but not less than (1) test for each mortar type.
3. Build masonry mortar cubes in the presence of the Testing Agency.
4. Build and test mortar cube prisms in accordance with ASTM C109.

3.09 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 non-masonry 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

END OF SECTION 04 22 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Structural steel framing members, support members, bracing members and connections.
2. Base plates, leveling plates, anchor bolts, leveling nuts, shear stud connectors, deformed bars welded to structural steel, and bolts.
3. Grouting under base plates.
4. Verification of anchor bolt setting and levels to assure adequate fit of the steel work.

1.02 REFERENCES

A. General:

1. The documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

B. ASTM International:

1. ASTM A27 / A27M Standard Specification for Steel Castings, Carbon, for General Application
2. ASTM A47 / A47M Standard Specification for Ferritic Malleable Iron Castings
3. ASTM A53 / A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4. ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
5. ASTM A123 / A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6. ASTM A153 / A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. ASTM A283 / A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
8. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
9. ASTM F3125 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
10. ASTM A385 Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
11. ASTM A500 / A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
12. ASTM A525 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
13. ASTM A36 / A36M Standard Specification for Carbon Structural Steel
14. ASTM A572 / A572M Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

15. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 16. ASTM A992 / A992M Standard Specification for Structural Steel Shapes
 17. ASTM D2092 Recommended Practices for Preparation of Zinc-Coated Steel Surfaces for Painting
 18. ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- C. American Welding Society:
1. AWS D1.1 - Structural Welding Code
- D. American Institute of Steel Construction (AISC):
1. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges except the following shall be added to 3.1 (f): Horizontal and vertical dimensions may not be shown entirely on the Structural Drawings.
 2. AISC 360 – Specification for Structural Steel Buildings
 3. AISC - Steel Construction Manual
 4. RCSC -Research Council on Structural Connections "Specification for Structural Joints Using High-Strength Bolts

1.03 DEFINITIONS

- A. Heavy Shapes: ASTM A6, Group 3 shapes with flanges thicker than 1-1/2 inches (12.5 mm), Group 4 shapes, and Group 5 shapes; welded built-up members with web or flange plates exceeding 1-1/2 inches (12.5 mm) in thickness

1.04 SUBMITTALS

- A. Shop drawings for structural steel fabrications shall be submitted for review prior to fabrication. Examples include, but are not limited to:
1. Complete fabrication and erection plans and procedures giving full information on aspects of the erection which will affect alignment, plumb and dimensional accuracy of the structure.
 2. Connections including size and spacing of bolts and welds.
 3. Indicate profiles, sizes, spacing, and locations of structural members, openings, camber and attachments. Indicate welded connections with AWS welding symbols. Indicate net weld lengths. Details of welding materials, equipment, sequence and technique to be used. Shop and erection details incorporating seismic critical welds shall include explicit references to corresponding weld procedure specifications.
 4. The Contractor shall survey, review and confirm as-built conditions prior to developing shop drawings. Field modifications to suit as-built conditions shall be at the Contractor's expense.
 5. Corrections or comments made on shop drawings during review do not relieve contractor from compliance with the requirements of the drawings and specifications. The review is only an examination of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all sizes, quantities, and dimensions; selecting fabrication and erection processes and techniques of construction; coordinating his work with that of all other trades; performing his work in a safe and satisfactory manner, etc..
- B. Mill Test Reports: Submit mill test reports indicating structural strength, destructive and nondestructive test analysis and chemical analyses from each heat of steel used in the work.

- A. Fabricate structural steel members in accordance with AISC specifications.
- B. Welders shall be qualified in accordance with AWS D1.1 for each process, position and joint configuration.
- C. Field survey anchor bolts for location and elevation prior to casting concrete.
- D. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-certified plant, category STD.
- E. Erector Qualifications: Company with a documented experience in performing the work of this Section and participates in the AISC Quality Certification program and is designated as AISC-certified erector, category CSE.

1.06 TESTS AND INSPECTIONS

- A. Welding Tests and Inspections
 - 1. All welds shall be visually inspected by an AWS Certified Weld Inspector in accordance with AWS D1.1 and in accordance with AWS B1.1 "Guide for Visual Examination of Welds"
 - 2. It is the Fabricator's responsibility to provide a CWI meeting the minimum requirements specified in AWS D1.1, Section 6.
 - 3. Additionally, 25% of full penetration welds shall be tested by ultrasonic testing in accordance with ASTM E164 and AWS D1.8
 - 4. Additionally, 100% of welds in moment connections shall be tested by ultrasonic testing in accordance with ASTM E164.
 - 5. Additionally, 100% of welds in column splice connections shall be tested by ultrasonic testing in accordance with ASTM E164.
- B. High-Strength Bolting Tests and Inspections
 - 1. All high strength bolts ASTM F3125 shall be manufactured, installed, and field tested in accordance with the "Specification for Structural Joints using High Strength Bolts" by RCSC, latest edition.
 - 2. It is the responsibility of the Erector to comply with the minimum requirements of the RCSC for visual inspections.

1.07 CONTRACTOR'S ENGINEERING SERVICES

- A. General: Where engineering services are required herein and excluded from EOR's contract, the Contractor shall retain a Professional Civil or Structural Engineer, referred to herein as the Contractor's Engineer. Documents prepared by the Contractor's Engineer shall be stamped and signed by a Professional Engineer licensed in the state where the project is located.
- B. The steel structure is a non-self-supporting steel frame and is dependent upon diaphragm action of the metal roof deck, ceiling framing system and gypsum covering, and attachment to the adjacent members for stability and for resistance to lateral forces. Provide all temporary supports required for stability and for resistance to lateral forces until these elements are complete and are capable of providing this support. All temporary shoring and bracing during erection is the responsibility of the Erector and Contractor.
- C. Metal stairs shown on plans are for illustrative purposes only. The Fabricator shall be responsible for the design of metal stairs. Shop Drawings, depicting the configuration, connection, and fabrication details shall be submitted to the structural Engineer of Record for review of design intent.

- D. Alternate connection details may be used if such details are submitted to the engineer for review and approval. However, the engineer shall be the sole judge of acceptance and the Contractor's bid shall anticipate the use of those details shown on the drawings. The Contractor is responsible for the design of such alternate details which they propose and provide stamped drawings for approval.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural Steel Members: A992 for rolled wide flange shapes.
- B. Plate, bars and channels: ASTM A36 unless otherwise noted on the drawings. Plates 2 inch thick and greater shall have Charpy V-Notch toughness of 20 ft-lb at 70 degrees F tested at any location permitted by ASTM A673.
- C. Structural Tubing: ASTM A500, Grade B. Structural tubing shall be new and contain a minimum of 75 percent recycled post consumer steel.
- D. Pipe: ASTM A53, Type E or S, Grade B. Pipe shall be new and contain a minimum of 75 percent recycled post consumer steel and not more than 0.05 percent sulphur.
- E. Shear Stud Connectors: ASTM A108, Grades 1010 through 1020 inclusive. Connectors shall be free of defects, cracks or bursts deeper than half the thickness from the periphery of the head to the shaft. After welding, studs will be the length shown on the drawings.
- F. Threaded Stud Connectors: Threaded studs in structural steel connections shall be reduced base studs conforming to ASTM A108, Grades 1010 through 1020 inclusive. After welding, studs will be the length shown on the drawings.
- G. Bolts and Nuts: Bolts in structural steel connections shall be ASTM F3125 Grade A325, Type I unless designated as Grade A490 on the drawings. Nuts shall be ASTM A563 Grade C or DH. Where galvanized connectors are called for on the drawings, they shall be galvanized in accordance with ASTM A153. Bolts conforming ASTM A307 and nuts conforming to ASTM A563 may be used in stair, handrail, miscellaneous steel and timber connections.
- H. Washers shall be flat and either circular, square or rectangular conforming to ASTM F436 Type 1. The finish of washers is to match the nut. Grade A325 bolts shall have washers under the head and Grade A490 bolts shall have hardened washers under the head and the nut.
- I. Threaded Anchor Rods: ASTM F1554 36-ksi yield strength, unless otherwise designated on the drawings.
 - 1. Finish: Hot dip zinc coating.
 - 2. Grout: Nonmetallic, shrinkage resistant, non-corrosive, non-staining, factory-packaged complying with ASTM C1107.
- J. Clevises and Turnbuckles: Cold-finished carbon steel bars, ASTM A108, Grade C1035.
- K. Welding Materials: Filler metals shall conform to Table 4.1 of AWS D1.1. Electrodes and equipment settings shall be as recommended by the filler metal manufacturer for the position, thickness and conditions of use. electrodes and filler metal shall be low hydrogen types. FCAW wire diameter shall not exceed the values in Section 4.14.1 of AWS D1.1.
- L. Touch-up Primer for Galvanized Surfaces: Tnemec series zinc rich organic primer.

2.02 CONNECTIONS

- A. Unless otherwise noted on the drawings, shop connections shall be welded and field connections, shall be bolted. Weld only in accordance with approved welding procedures.
- B. All butt, groove, or bevel welds shall be complete, full penetration.
- C. Welding electrodes shall be E70XX for manual arc welding and F7X-EXXX for submerged arc welding.
- D. Minimum weld size shall be 3/16" unless noted otherwise.
- E. Bolts shall be assumed snug-tightened unless noted otherwise.
- F. Oversize holes shall not be allowed without approval of the Engineer of Record. If oversize holes are elected and approved, bolts shall be slip-critical.
- G. Where possible, all bolt holes in structural steel shall be drilled or punched in the shop. Any holes required to be made at the project site shall be mechanically drilled or punched. No burning of holes shall be allowed.

2.03 FABRICATION

- A. Fabricate structural steel in accordance with the applicable provisions of the AISC Specifications for Structural Steel Buildings. Where practical, fabricate and assemble in the shop.
- B. Obtain field measurements necessary for steel fabrication.
- C. Perform high strength shop bolting in accordance with the appropriate ASTM specification. Complete high strength shop bolting before welding.
- D. Splices in structural steel not shown on the structural drawings will not be accepted without specific approval of the Structural Engineer. Submitted splices shall be designed the Fabricator's delegated design engineer and stamped by an Engineer licensed in Louisiana.
- E. The General Contractor and Steel Erector shall notify the Architect of any fabrication or erection errors or deviations and receive written approval before any field corrections are made.

2.04 FINISH

- A. Shop prime structural steel members unless noted otherwise. Use SSPC-SP2 surface preparation or better. Apply two coats of different colored primer to areas which will be inaccessible after erection or assembly. Do not prime surfaces that will be fireproofed, galvanized, fully embedded in concrete or mortar, within 3 inches of field welds, or on the faying surface of high strength bolted friction connections.
- B. Galvanize structural steel members indicated on the Drawings as galvanized in accordance with ASTM A123 and A385 after fabrication. Prepare galvanized surfaces to be painted in accordance with ASTM D2092 and shop coat with a compatible primer. Repair damaged galvanizing in accordance with ASTM A780.
- C. High Performance Coatings - All exposed or visible structural steel shall be painted per Architect's specification.

2.05 ERECTION

- A. Provide anchor bolts and other items embedded in concrete.

- B. Furnish and install temporary supports and internal braces necessary to support structural steel during erection. Temporary supports and braces shall be adequate for anticipated wind, seismic, equipment and erection loads. Remove temporary shoring after the steel erection is complete.
- C. Erect structural steel in accordance with the AISC Specifications for Structural Steel Buildings, except as modified herein. Where members cannot be properly assembled due to mis-fabrication or deformation due to handling or transportation, the condition shall be reported to the Architect with a proposed method of correction for approval.
- D. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- E. Perform high strength bolting in accordance with the appropriate ASTM specification. Complete high strength bolting before field welding.
- F. Do not field cut or alter structural members without approval of the Architect.
- G. Grout base plates with non-shrink grout.
- H. Where field welding to existing structural members is required, the Contractor shall confirm the weldability of the existing steel by cutting or drilling samples and having them tested by the Contractor's Independent Testing Laboratory. The testing laboratory shall recommend the location for taking samples, provide a report on weldability, recommend the type of electrode and weld and inspect the final welds. The Contractor will be responsible for preparing the existing steel for welding and touch of the surfaces. Use low hydrogen electrodes when welding to existing steel.
- I. Existing framing requiring welding shall be thoroughly cleaned to ensure proper welding.
- J. Provide temporary shoring when welding to existing steel.
- K. Field welded surfaces within 4 inches of weld shall be cleaned and ground smooth. After welding, coat the exposed area with appropriate primer/paints as specified.
- L. 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/D1.1M and manufacturer's written instructions.
- M. No flame cutting or enlarging will be allowed without specific approval of the Structural Engineer.

2.06 ERECTION TOLERANCES

- A. Tolerances shall be in accordance with the AISC Code of Standard Practice. Crane rail tolerances shall comply with CMAA Specification 70.

END OF SECTION 05 12 00

SECTION 05 31 00
STEEL DECK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Metal form deck.
 - 3. Supplementary framing for openings up to and including 18 inches.
- A. Bearing plates and angles

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM A 36/A 36M - Specification for Carbon Structural Steel; latest edition
 - 2. ASTM A108. Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; latest edition
 - 3. ASTM A 123/A 123M -Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel. Products; latest edition
 - 4. ASTM A 653/A 653M -Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; latest edition
 - 5. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened; latest edition
- B. AWS:
 - 1. AWS D1.1/D1.1M -Structural Welding Code - Steel; American Welding Society; 2010.
 - 2. AWS D1.3 -Structural Welding Code - Sheet Steel; American Welding Society; 2008.
- C. Other Standards:
 - 1. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.
 - 2. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Submit manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Nucor-Vulcraft Group: www.vulcraft.com.
 - 2. New Millenium

2.02 STEEL DECK

- A. Roof Deck: See Design Drawings.
- B. Metal Form Deck: See Design Drawings.
- C. Metal Composite Deck: See Design Drawings.
- D. Accessory Materials:
 - 1. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
 - 2. Welding Materials: AWS D1.1.
 - 3. Fasteners: Galvanized hardened steel, See Structural General Notes.
 - 4. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions.
- B. Align and level.
- C. Main support members for the metal deck are shown. During preparation, submission, and review of shop drawings, any additional angles or miscellaneous attachment details required to support the metal deck at the required elevation shall be provided by the Structural Steel Contractor.
- D. Fasten deck to structural steel framing in accordance with the Design Drawings.
- E. On wood surfaces provide minimum 4 inch bearing.
- F. At mechanically fastened male/female side laps and end laps, fasten as per the structural drawings.
- G. At deck openings from 6 inches to 18 inches in size, provide minimum 3 x 3 x 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and mechanically attach to deck at each flute.
- H. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
- I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- J. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

END OF SECTION 05 31 00

SECTION 05 4000

COLD-FORMED METAL 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
 - 3. Soffit framing.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 09 2116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
 - 3. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. 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.

D. Delegated-Design Submittal: For cold-formed steel framing.

1.5 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 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.

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.

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

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

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CEMCO; California Expanded Metal Products Co.
 2. ClarkDietrich Building Systems
 3. MarinoWARE.
 4. MBA Building Supplies
 5. SCAFCO Steel Stud Company.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design cold-formed steel framing, indicating loads, anchor type, embedment length, embedment depth. No anchor greater than $\frac{3}{4}$ inch embedment shall be used unless a full scan of the post tensioned slab is provided documenting the location of each post tensioned strand in the area where anchors will be installed.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated.
 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. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft..
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and ASTM C955 AISI S200 and ASTM C955, and Section 8 AISI S240.
- 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.
- E. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".

2. 01 8116 "Low Emitting Materials Restrictions".

- F. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- G. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the most recent Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines as found on EC3 and as listed below for reference:
 2. Embodied Carbon (GWP) Baselines: Steel
 - a. Wire & Mesh – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 - b. Plate Steel 3.0 kg CO₂eq per kg/1.4 kg CO₂eq per lb.
 - c. Cold Formed Steel – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
 3. System Boundary: Product Stage A1-A3.
 4. Declared Units: 1 kilogram or 1 pound.
 5. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Structural Steels, v.1.0/1.6/1.0, 2017-11-30.
 - b. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - c. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - d. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance.
 2. Coating: G60, A60, AZ50, or GF30.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: G60.

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.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.

2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- E. 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.
 - b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch 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.
 - b. Flange Width: Insert dimension equal to sum of outer deflection track flange width plus 1 inch.
- F. 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.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Flange Width: 2 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Flange Width: 1-1/4 inches.
 3. Provide fire rated single deflection track at rated wall assemblies.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

- E. 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.
 - b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch 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.
 - b. Flange Width: Insert dimension equal to sum of outer deflection track flange width plus 1 inch.
- F. 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.

2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- 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.

2.8 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 and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M MIL-P-21035B or SSPC-Paint 20.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide Duragrout by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 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 screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, 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 are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. 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 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- K. Notify Architect and Acoustical Consultant prior to covering or enclosing framing, resilient channels, isolators, ducts, and pipes in sound-rated constructions to allow for on-site review and correction as required. To facilitate any acoustical "tuning" notify Architect and Acoustical Consultant prior to installing fabric or other coverings over acoustical treatments.

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 as indicated.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Connect 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 apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Connect drift clips to cold-formed steel metal 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 apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

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

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

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 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

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Steel framing and supports for overhead doors and grilles.
 2. Steel framing and supports for countertops.
 3. Steel tube reinforcement for low partitions.
 4. Steel framing and supports for mechanical and electrical equipment.
 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 6. Elevator machine beams, hoist beams, and divider beams.
 7. Steel shapes for supporting elevator door sills.
 8. Slotted channel framing.
 9. Shelf angles.
 10. Metal ladders.
 11. Alternating tread devices.
 12. Miscellaneous steel trim including steel edgings.
 13. Metal bollards.
 14. Abrasive strips.
 15. Metal downspout boots.
 16. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
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.
- C. Related Sections:
1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 2. Section 04 2000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 3. Section 05 1200 "Structural Steel Framing."
 4. Section 07 7200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.3 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Fasteners.
 - 2. Shop primers.
 - 3. Slotted channel framing.
 - 4. Manufactured metal ladders.
 - 5. Alternating tread devices.
 - 6. Metal bollards.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Certificates:** For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for overhead doors and grilles.
 - 2. Steel framing and supports for countertops.
 - 3. Steel tube reinforcement for low partitions.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Elevator machine beams, hoist beams, and divider beams.
 - 7. Steel shapes for supporting elevator door sills.
 - 8. Shelf angles.
 - 9. Metal ladders.
 - 10. Alternating tread devices.
 - 11. Miscellaneous steel trim including steel edgings.
 - 12. Metal bollards.
 - 13. Metal downspout boots.
 - 14. Loose steel lintels.

- D. Samples for Verification:
 - 1. Abrasive strip.
- E. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 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."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 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: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.

4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- 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, ambient; 180 deg F, material surfaces.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- F. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the most recent Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Steel
 - 1) Rebar – 2.0 kg CO²eq per kg/.91 kg CO²eq per lb.
 - 2) Wire & Mesh – 3.0 kg CO²eq per kg/ 1.4 kg CO²eq per lb.
 - 3) Plate Steel 3.0 kg CO²eq per kg/1.4 kg CO²eq per lb.
 - 4) Structural Steel
 - a) Hot-Rolled – 2.5 kg CO²eq per kg/ 1.1 kg CO²eq per lb.
 - b) Hollow – 2.5 kg CO²eq per kg/ 1.1 kg CO²eq per lb.
 - 5) Cold Formed Steel – 3.0 kg CO²eq per kg/ 1.4 kg CO²eq per lb.
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 kilogram or 1 pound.
 2. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Structural Steels, v.1.0/1.6/1.0, 2017-11-30.
 - b. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - c. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - d. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
 3. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

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. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- F. 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.
- G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- H. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- I. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0677-inch minimum thickness; unfinished.
- K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- L. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- M. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- N. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- O. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- P. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- Q. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 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, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners fastening aluminum stainless steel or nickel silver.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; 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. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Screws: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1.
- K. 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, conducted by a qualified independent testing agency.
- L. 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.
- M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting" and Section 09 9123 Interior Painting."
- 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.

- F. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide Duragrout by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- G. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 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 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 and contour of welded surface matches that of adjacent surface.
- 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 will be 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, with a minimum 6-inch embedment and 2-inch

hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 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 miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Space siderails of elevator pit ladders 12 inches apart.
 - 3. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 4. Rungs: 3/4-inch-diameter steel bars.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. 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.
 - 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 1/2 inch in least dimension.

8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize exterior ladders, including brackets and fasteners.

2.9 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 1. Basis of Design: Lapeyre alternating tread, 68 degree vertical angle
 2. Tread depth shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 9-1/2 inches.
 3. Tread depth shall be not less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 8 inches.
 4. Fabricate from steel and assemble by welding or with stainless steel fasteners.
- B. Galvanize exterior steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.10 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.

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 1. Cap bollards with 1/4-inch-thick steel plate.
 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

- D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4 inch steel machine bolt.
- E. Prime bollards with zinc-rich primer.

2.12 ABRASIVE STRIPS

- A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Basis of Design: Subject to compliance with requirements, provide Amstep 224A or a comparable product by one of the following:
 - a. [Armstrong Products, Inc.](#)
 - b. [Balco, Inc.](#)
 - c. [Nystrom, Inc.](#)
 - 2. Provide solid-abrasive-type units without ribs.
 - 3. Nosings: Square-back units, 2 inches wide, without lip, with abrasive filler in contrasting color ADA compliant.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.13 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
 - 1. Outlet: Vertical, to discharge into pipe.
- B. Prime cast iron downspout boots with zinc-rich primer.

2.14 METAL BAR GRATINGS

- A. Rectangular Bar Grating:
 - 1. Traffic Surface: As indicated.
 - 2. Finish: Galvanized.
 - 3. Basis of Design: McNichols GW, Welded Rectangular Bar Grating.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
 - 2. Furnish threaded bolts with nuts and washers for securing grating to supports.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- D. Do not notch bearing bars at supports to maintain elevation.

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 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 unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.17 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.

2.18 ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

- A. AESS: Architecturally exposed structural steel Structural steel that is categorized by ANSI/AISC 303, Section 10 with the following definitions:
 - 1. AESS 3: Feature Elements in Close View – applies to all exposed exterior steel elements.
 - 2. AESS 4: Showcase Elements – applies to all exposed interior steel elements.
- B. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
 - 1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.
- C. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
 - 1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.
 - 2. Make welds uniform and smooth. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
- D. Category AESS 3:
 - 1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. All sharp edges ground smooth.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
6. Remove weld spatter, slivers, and similar surface discontinuities.
7. Provide Visual Samples.
8. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
9. Conceal fabrication and erection markings from view in the completed structure.
10. Make welds uniform and smooth.
11. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
12. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
13. Orient HSS seams as indicated or away from view.
14. Align and match abutting member cross sections.
15. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
16. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

E. Category AESS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. All sharp edges ground smooth.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
6. Remove weld spatter, slivers, and similar surface discontinuities.
7. Provide Visual Samples.
8. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
9. Conceal fabrication and erection markings from view in the completed structure.
10. Make welds uniform and smooth.
11. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
12. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
13. Orient HSS seams as indicated or away from view.
14. Align and match abutting member cross sections.
15. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
16. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
17. Treat HSS seams to appear seamless.
18. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
19. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
20. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

- F. Erection marks, painted marks, and other marks are permitted on galvanized- steel surfaces of completed structure.

2.19 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.20 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 primers specified in Section 09 9113 "Exterior Painting" and primers specified in Section 09 9123 "Interior Painting" unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Ferrous Metals - SSPC-SP6 Commercial Blast Cleaned Steel
 - 2. Galvanized Metals - SSPC-SP16 Brush-Off Blast Cleaning. Uniform scarification with using fine abrasive at 20-40 psi at the blast nozzle to minimizing damage to the galvanizing.
- 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.

2.21 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

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. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.
- C. 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.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.

- B. Anchor bollards to existing construction with through bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- D. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.
- E. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.
- F. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 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 grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.6 AECS ERECTION

- A. Take special care during erection to avoid marking or distorting the AECS and to minimize damage to shop painting. Set AECS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
 - 1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
 - 2. Grind tack welds smooth.
 - 3. Remove backing and runoff tabs, and grind welds smooth.
 - 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 - 5. Conceal fabrication and erection markings from view in the completed structure.

3.7 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 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 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 59 65

ANIMAL CAGING RIGID PANEL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Design, engineering, fabrication, testing, and installation of interior and exterior rigid panel animal caging, animal transfer doors, operators, and keeper gates. Items fabricated and installed under this Section includes, but is not necessarily limited to:
 - a. Rigid caging panel systems.
 - b. Miscellaneous framing, joining, and mounting components.
 - c. Keeper access doors and gates.
 - d. Cable-operated transfer door assemblies.
 - e. Push-pull bar transfer door assemblies.
 - f. Full-scale operable mock-ups.
 - g. Finish hardware and schedule.
 - h. Accessories attached to caging panels and keeper gates.
 - i. Miscellaneous access doors, ports, and panels in caging or gates.
 - j. Miscellaneous non-metallic rigid panels attached to rigid caging.

B. Related Requirements:

- 1. Division 01 Section "Animal Management Requirements of Construction".
- 2. Division 05 Section "Metal Fabrication".
- 3. Division 10 Section "Cable Netting Structures and Rigging Systems" for fences, gates, and animal barriers with cables and hand-woven mesh netting.
- 4. Division 32 Section "Chain Link Fences and Gates".
- 5. Division 32 Section "Fencing & Gates".

1.3 PRE-QUALIFIED METAL FABRICATORS AND INSTALLERS

- A. Only Subcontractors whose experience and workmanship that have been previously reviewed and pre-qualified by the Architect/Exhibit Designer for the Work of this Section. Qualifications for companies include a minimum of ten (10) years' experience in metal work of this type, plus a minimum of three (3) similar projects involving containment of animals. Companies requesting consideration shall submit written and photographic proof of previously performed projects.

1.4 REFERENCES

- A. ASTM A36 Structural Steel.
- B. ASTM A53 Hot Dipped, Zinc coated Welded and Seamless Steel Pipe.
- C. ASTM A325 High Strength Bolts for Structural Steel Joints.
- D. ASTM A386 Zinc Coating (Hot Dip) on Assembled Steel Products.
- E. ASTM A500 Cold formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- F. ASTM A501 Hot formed Welded and Seamless Carbon Steel Structural Tubing.
- G. FS TT P 31 Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.
- H. FS TT P 641 Primer Coating, Zinc Dust Zinc Oxide (for Galvanized Surfaces).
- I. FS TT P 645 Primer, Paint, Zinc Chromate, Alkyd Type.
- J. NAAM Standard HMMA 863 – Guide Specifications for Detention/Security Hollow Metal Doors and Frames.
- K. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes.
- L. ASTM A666 Standard Specification for Austenitic Stainless-Steel sheet, strip, and flat bar.
- M. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- N. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- O. ASTM B580 – 79 Standard Specification for Anodic Oxide Coatings on Aluminum.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1, "Structural Welding Code – Steel".
 - 2. AWS D1.2, "Structural Welding Code – Aluminum".
 - 3. AWS D1.6, "Structural Welding Code – Stainless Steel".
- B. The caging systems shall be the product of a manufacturer who has demonstrated by actual installations of a similar nature that its product is of the type required. The contractor shall include all supplementary parts necessary or required for a complete and satisfactory installation within the true meaning and intent of the drawings.

1.6 FIELD MEASUREMENTS

- A. Prior to submission of shop drawings, the Caging Contractor shall verify field measurements of all adjacent construction. Shop drawings shall be based on and include these field measurements. Notify the Architect in writing of any major discrepancies between the Contract

Documents and field measurements prior to the start of fabrication.

1.7 INFORMATION SUBMITTALS

- A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding Certificates.

1.8 SUBMITTALS

- A. Pre-detailing Conference: Contractor shall schedule and hold a prefabrication meeting to coordinate specification and shop drawing issues prior to the first shop drawing submittal. Attendees shall include the contractor's project manager, the detailer, the fabricator, the erector, the architect, the structural engineer of record and the testing agency.
- B. Submit Shop Drawings, Product Data, Samples, and Mock-ups to the requirements of Division 01 Section "Submittal Procedures".
- C. Shop Drawings:
 - 1. Indicate all dimensions, materials, profiles, sizes, connections, anchorage, fasteners, and accessories.
 - 2. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
- D. Product Data: Provide product data on all hardware components including sprockets, wheels, ball-screws, trucks, tracks, hinges, cables, winches, fasteners, finish systems, and other similar items.
- E. Samples:
 - 1. Submit one (1) 12" x 12" sample of each rigid caging panel type indicated on drawings, including alternate infill panel materials such as HDPE, metal, etc. Each sample must include a frame showing typical weld/attachment details to panel frame if applicable.
 - 2. Submit one (1) sample each of: sheaves, pulleys, cables, cover plates.
 - 3. Submit one (1) 8" x 8" sample of each transfer door panel material type if different than caging panels listed above.
- F. Full-Scale Mock-Up: Refer to section "Full-Scale Mock-Ups" below for requirements.
- G. Fabrication of all caging components shall be contingent on the results of the review process and acceptance of the working mock-up.

1.9 FULL-SCALE MOCK-UPS

- A. The following full-scale mock-ups shall be constructed on the project site for review and approval by the Architect and Owner. Mock-ups may be constructed in-place or elsewhere on the project site in a setting that demonstrates final conditions. The Contractor must schedule the construction and review of all mock-ups to allow adequate time for full review, adjustment, documentation, and approval in writing before any final fabrication or installation can begin.

1. Cage-Front: typical caging wall consisting of multiple caging panels including base, side, and top mounting details as well as panel-to-panel connections.
 2. Keeper Gates: one (1) full scale and operable gate for each type indicated in the Contract Documents.
 3. Transfer Doors: One (1) full-scale and operable door for each type indicated in the Contract Documents.
 4. Transfer Door Operators: One (1) fully functional door operator of each type indicated in the Contract Documents. Operators must be paired with a transfer door mock-up as detailed in the Contract Documents.
- B. All mock-ups shall serve to demonstrate construction methods and workmanship including finishes and operability where required.
- C. Coordinate field reviews of all mock-ups with representatives of Owner and Architect. Make all adjustments required by the Owner and/or Architect at no additional cost to the Project. If significant adjustments are required, schedule an additional review with the required parties.
- D. Obtain from the Owner and Architect written statements accepting mock-ups as the basis for construction of the respective assemblies and systems. Do not begin fabrication of any affected assemblies until written acceptance is obtained.
- E. Do not alter, move or destroy "mock-up" panels until approval is granted or as otherwise directed by the Architect. Damage or destruction of the panel prior to approval shall be cause for its replacement at the expense of the Contractor.
- F. Mock-ups may remain as part of the final work if accepted by the Owner and Architect. Mock-ups that are not to remain as part of the Final Work shall be dismantled and removed off-site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Separate dissimilar metal to metal attachments with non-conductive, high-density material.

2.2 PANEL FRAMEWORK MATERIALS

- A. General – Materials as indicated on drawings.
- B. Steel Tubing: Galvanized steel in shapes and sizes indicated on the Drawings conforming with ASTM A501.
- C. Steel Sections: ASTM A36.

2.3 PANEL INFILL MATERIALS

- A. General – Materials as indicated on drawings.
- B. Woven Wire Mesh: Lock-crimp weave in sizes indicated on drawings, measured center to center of wires. Materials as indicated on drawings and as specified below.
1. Galvanized Steel: Shall be galvanized after fabrication, to a minimum of G-90 coating

- designations (ASTM A-653).
 - 2. All mesh panel assemblies shall be free from warp.
 - C. Welded Wire Mesh: Sizes indicated on drawings, measured center to center of wires. Materials as indicated on drawings and as specified below:
 - 1. Galvanized: Hot dipped galvanized G-90 coating.
 - 2. Stainless Steel: Type 304.
 - D. Solid Non-Mesh Infill: Sizes and materials as indicated on the drawings.
 - 1. HDPE: smooth; chosen from manufacturer's full range of standard colors. Molded sheet in the thickness indicated on drawings. Plastic panels shall not be milled to a thickness other than provided by the manufacturer.
 - 2. Sheet Steel: Galvanized G-90 coating.
- 2.4 KEEPER DOORS & GATES AND ANIMAL TRANSFER DOORS & GATES
- A. General – Materials as indicated on drawings.
 - B. Substitutions to the basis-of-design products listed here must be approved by the Architect. Refer to Division 01 section "Substitution Procedures".
 - C. Requirements of "Panel Framework Materials" and "Panel Infill Materials" above shall also apply to all caging doors and gates.
 - D. Solid Plastic Door Panels:
 - 1. Molded sheet in the thickness indicated on drawings. Plastic panels shall not be milled to a thickness other than provided by the manufacturer.
 - 2. Door panels shall have machined edges on all sides.
 - 3. All corners shall have a minimum radius of 1/2" unless specifically noted otherwise.
 - 4. All edges shall be eased to a minimum of 1/16" unless specifically noted otherwise.
 - E. Keeper Door & Gate Components:
 - 1. Padlocks: all padlocks will be provided by the Owner. Contractor shall request sample padlock from owner to test fit.
 - 2. Hinges: (unless noted otherwise)
 - a. For doors and gates up to 4 feet in width: Basis-of-Design; Hager BB1199; Stainless Steel, 4-1/2 x 4-1/2, blank leaf. Hinge number and distribution must be verified by the manufacturer to support full weight of the door/gate. Or approved equal.
 - b. For gates wider than 4 feet: Basis-of-Design; Roller Bearing, Weld-on Greaseable Hinge; 3,000lb capacity per pair; SKU #907000 from hardwaresource.com. Or approved equal.
 - 3. Door Pull Handle: Basis-of-design: Richards Wilcox 83.00002SS or 81.00002ZC. Provide material to match door framing material.
 - 4. Slide Bolts: as detailed in drawings.
 - 5. Cane Bolts: In locations shown on drawings. 3/4" dia. Galv steel rod, lockable with padlock in up and down positions; secured with 1" dia. Schedule 40 galv steel pipe sections welded to gate. Minimum of 3" embedment into receiver below grade.

6. Silencers: Provide two rubber silencers at each stop plate. Mounting holes shall be factory drilled for a snap-in silencer installation. Glued on or adhesive back silencers are unacceptable

F. Animal Transfer Door & Gate Components:

1. Padlocks: all padlocks will be provided by the Owner. Contractor shall request sample padlock from owner to test fit.
2. Overhead Truck and Track Systems: Unless noted otherwise, Basis-of-design: Richards Wilcox model and material as indicated on drawings. Truck and track selection must be verified by the manufacturer to support the full weight of door.
3. Operator Cables: 7x19 stainless steel 1/8" diameter cable. Provide Nicopress termination sleeves on each end, other splices are not permitted.
4. Sheaves & Pulley Blocks: as detailed in drawings.
5. Continuous Cable Pull Handle Operator: As detailed on drawings.
6. Push-Pull Operators: as detailed in drawings.
7. Cane Bolts: In locations shown on drawings.

2.5 OTHER MISCELLANEOUS MATERIALS

- A. Welding Materials: Type required per AWS for materials being welded.
- B. Miscellaneous Straps, Plates, and Bars: Sizes and materials as indicated on drawings and as specified below.
1. Galvanized: Hot dipped galvanized.
 2. Stainless Steel: Type 304.
 3. Aluminum: ASTM B209, Alloy 6061-T6, mill finish.
- C. Fasteners, Bolts, Nuts, and Washers: Material matching caging panels; all bolts, machine screws and fasteners shall be either torx or hex socket round head and flat head as indicated on the drawings except where specifically noted otherwise.
- D. Post-Installed Anchors:
1. Elevated monolithic concrete: Basis-of-Design Hilti Stainless Steel, Type 304, "kwik-Bolts"
 2. Concrete masonry and concrete at floor level: Basis-of-Design Hilti HIT-HY 200 chemical adhesive anchors for concrete block walls in sizes and materials indicated on the Drawings.
 3. Contractor shall confirm anchor types installed are appropriate for surrounding construction types.
- E. Touch up Cold Galvanizing Compound for Galvanized Surfaces: ZRC containing 95% zinc, or approved equal, to match color of galvanized panels for all field welded surfaces. Cold galvanizing is intended for limited touch-up only and will be acceptable only for those areas necessary for field welds.
- F. Sealant: refer to Division 07 section "Joint Sealants". All sealants required for rigid panel animal caging materials and details are considered animal areas.
- G. Rigid Insulation: Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work. Do not install until any unsatisfactory conditions are corrected. Beginning Work constitutes contractor's acceptance of conditions as satisfactory.
- B. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.
- C. Clean and strip site primed steel items to bare metal where site welding is scheduled.
- D. Make provision for erection loads with temporary bracing. Keep work in alignment.
- E. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate trades.

3.2 COORDINATION

- A. Coordinate all material requirements with other pertinent specification Sections relevant to the Work of this Section.

3.3 PREPARATION OF RIGID CAGING ASSEMBLIES

- A. Verify dimensions on site prior to shop fabrication.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Fabricate items with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline. All oversized holes required for fabrication shall be welded & plugged. No holes, cavities, or other voids will be acceptable, unless specifically designed into the caging system.
- D. Continuously seal joined members by continuous welds.
- E. Fit and shop assemble in largest practical sections, for delivery to site.
- F. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius of 1/8". Radius all corners to 1/4".
- G. Galvanize items to minimum 2.0 oz./sq. ft. zinc coating in accordance with ASTM A386.
- H. Remove all burrs from assemblies after galvanizing. Assemblies are to be smooth to the touch and not cause scratches or cuts to Zoo staff or animals.
- I. Do not prime surfaces in direct contact bond with concrete or where field welding is required. Prime paint items scheduled with one coat.

3.4 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.

- B. Perform field welding in accordance with AWS D1.1, AWS D1.2 or AWS 1.6 appropriate to material being welded.
- C. After installation, touch-up field welds, scratched or damaged surfaces with specified touch-up primer.
- D. After installation, remove any remaining sharp edges, burrs, corners and slivers that, in the opinion of the Architect, and/or Owner injure animals or keepers.
- E. All non-welded connections must use mechanical fasteners. Adhesive is not permitted.
- F. Apply specified sealant to all gaps in any of the following areas:
 - 1. Between adjacent construction.
 - 2. Where specifically detailed.
 - 3. Where required to comply with the Animal Management Requirements of Construction procedures listed elsewhere in this Specification Section.

3.5 WELDING REQUIREMENTS

- A. All exposed welds shall be ground smooth and galvanized.
- B. Remove all sharp edges, burrs, corners, and slivers, which in the opinion of the Architect and/or Owner, could injure animals or keepers.

3.6 ANIMAL MANAGEMENT AND REQUIREMENTS OF CONSTRUCTION

- A. Refer to Division 01 section "Animal Management Requirements of Construction" for general requirements for working in an animal management setting and specific detailing requirements that may not be indicated specifically in the drawings.
- B. Typical details provided in the Drawings for animal areas apply to this work. Notify the Architect if any clarification is required.

END OF SECTION 05 59 65

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SECTION 06 00 00 – FINISHES - EXHIBITS

PART 1 GENERAL REQUIREMENTS

1.01 SUMMARY

- A. Section Includes:
 - 1. This work includes the furnishing of all labor, materials and equipment, necessary for the proper and complete painting and staining of the all exhibit items listed below. Allow within the contract bid allowance for paint and/or stain finishes at all exhibit items to the level of finish as approved by Designer. Paint and/or stain shall be used as applicable to render desired aesthetic finishes to miscellaneous items. In addition to work indicated or scheduled to be painted and/or stained, existing work to remain which is damaged, changed or repaired as a result of work specified under other sections shall also be painted/or stained to extent specified hereinafter.
- B. Products Furnished but not Installed Under this Section: None
- C. Products Installed but not Furnished Under this Section: None
- D. The Contract Forms, Conditions of this Contract, and Sections 01 00 00 - General Requirements and 02 00 00 - Existing Conditions apply to the work of this section.

60 10 00 Exhibit Signage and Graphics
- E. The following categories of work are not included as part of painter-applied finish work or are included in other sections of the specifications, except as otherwise shown on drawings are specified herein.
 - 1. Pre-Finished Items: Unless otherwise indicated, do not include painting for pre-finished items such as (but not limited to) graphic standoff blocks or interactives
 - 2. Finished Metal Surfaces: Metal surfaces of galvanized steel, aluminum, stainless steel, bronze and similar finished materials shall not be painted, except as otherwise specified.
 - 3. Operating Parts and Labels: Do not paint any moving parts of operating units, mechanical and electrical parts, such as interactive displays, operable doors, mobile carts, etc.

1.04 DEFINITION

- A. The word "Paint" as used herein means all coating systems materials, except special coatings specified under another section, and includes primers, sealers and fillers, enamels and other applied materials whether used as prime, intermediate or finish coats.

1.05 SAMPLES

- A. Submit for approval not less than 3 weeks before any painting is scheduled to start. New samples shall be submitted to replace rejected samples. Obtain approval in writing before delivering materials.

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- B. Submit a schedule of materials indicating location in project of primers and finish coats for appropriate substrates and to show where specific total colors will be used.

1.06 APPROVAL

- A. Material furnished shall match approved sample in color and sheen. Insofar as practicable, paint or stain shall be factory mixed for application to surfaces involved without thinning or other adulteration on job, except as modified below.

1.07 FIELD ADJUSTMENT OF FINAL COLOR

- A. Minor tinting to adjust finish coat to either lighter or darker shade shall be done in fabrication facility or field as directed. Extensive changes in color shall be done in fabrication facility or field if required, and an adjustment will be made in contract price to cover cost; a change order amount being agreed upon in advance.

1.08 LIST OF PROPOSED MATERIALS

- A. This submittal shall include full identifying product names and catalog numbers. Materials for prime coats, undercoats, finish coats and thinning applied to same surface shall be produced by same manufacturer.

1.09 DELIVERY AND STORAGE

- A. Deliver materials to job in original containers with labels intact and seals unbroken. Store material and painter's tools in Exhibit Fabricator's job box or in an Owner-designated room for this use only. Keep storage place clean and neat and damage to it shall be corrected. Keep paint and other volatile material tightly covered at all times when not in actual use. Remove soiled and oily rags and waste from building every night and take every precaution to prevent spontaneous combustion.

1.10 ENVIRONMENTAL CONDITIONS

- A. Interior Painting: If applicable, maintain temperature in building at constant 65 degrees F. or above. During drying of plaster and masonry and provide adequate ventilation for escape of moisture from building, in order to prevent mildew, damage to other work and improper drying of paint. Once painting has commenced, provide constant temperature of 65 degrees F. or above, and prevent wide variations in temperature which might result in condensation on freshly painted surfaces. Before painting is started in any area, broom-clean it and remove excessive dust from all areas to be painted. Broom cleaning, after painting operations begin in a given area will not be allowed; cleaning shall then be done with only commercial vacuum cleaning equipment. Provide adequate illumination in all areas where painting operations are in progress.
- B. Exterior Painting: Exterior painting shall not be performed when the temperature is below 50 degrees F., while the surface is damp, during cold, rains, or frosty weather; or when temperature is likely to drop to freezing within 24 hours. Avoid painting surfaces while they are exposed to hot sun.

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- C. During period of inclement weather, painting may be continued by enclosing the surfaces with temporary shelters and applying artificial heat, provided the temperature requirements are maintained.

1.11 COOPERATION WITH OTHER TRADES

- A. Schedule this work and coordinate it with other trades and do not proceed until other work and/or job conditions are as required to achieve satisfactory results. Examine drawings and specifications for the work of various other trades and become familiar with all their provisions regarding painting. Surfaces that are left unfinished by requirements of other sections shall be painted or finished as part of the work covered by this section.

1.12 EXAMINATION OF SURFACES

- A. Examine surfaces to receive paint finishes, in accord with Contract Conditions, for defects which cannot be corrected by procedures specified herein under "Preparation of Surfaces" and which might prevent satisfactory painting results. Do not proceed with work until such defects are corrected. Commencing of work constitutes acceptance of surfaces and thereafter, Exhibit Fabricator shall be responsible for satisfactory results as required herein.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers: Products of the following manufacturers similar to those specified herein will be acceptable for use on the Project when approved by Designer.

- 1. Paint
 - Benjamin Moore & Company
 - Devoe Division of Celanese Coatings Company
 - Martin-Senour Company
 - PPG Industries
 - Pratt & Lambert
 - The Sherwin-Williams Company
- 2. Powder Coat Paint Finish
 - a. Pre-treatment
 - Fremont Industries
 - (612) 496-3027
 - b. Powder Coat
 - Morton Powder Coating/Morton Thiokol
 - Fuller Obrien Co.
 - H.B. Fuller Co.
 - Tiger Drylac

- B. Paint

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1. Coatings: Ready-mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
 2. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.
 3. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Powder Coatings and Galvanizing
1. Pretreatment for powder coating
 - a. Three stage Iron Phosphate treatment applied by recirculating pressure spray or immersion. final rinse prior to painting shall be a seal rinse with the purpose to promote good paint adhesion, increase corrosion resistance, remove harmful residues and prevent rusting prior to paint application. Application and procedure shall be as recommended by powder coatings manufacturer.
 2. Powder Coatings
 - a. Polyester Powder Electro-Statically applied and baked at 375 degrees for 40 minutes.
 - b. Minimum coverage thickness shall be two to three mill thousandths.

Physical Form	Free Flowing Powder
Particle Size	30 to 70 micron
Specific Gravity	1.2 – 1.8 (depending on color)
Coverage	160 to 106 sq. ft./lb/mil (depending on color)
Curing Schedule(Metal Temp.)	30 Min. @ 360 Deg. F.
	20 Min. @ 380 Deg. F.
	10 to 15 Min. @ 400 Deg. F.
	8-10 Min. @ 425 Deg. F.

Typical Performance

Substrate	Iron Phosphated Steel
Cure Schedule	20 Min. @ 375 Deg. F. Metal Temp.
Film Thickness	1.5 – 2.0
60 Deg. Gloss	15 to 95
Pencil Hardness	H to 2H
Impact-Direct (inch lb.)	- 100 – 160
Impact-Reverse (inch lb.)	- 90 – 140
Adhesion	Cross Hatch – No Removal by Tape.
Flow	Good
Mar Resistance	Good
Xylol Resistance	(4 Hr. Contact) – Softens

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	(Recovers).
Alcohol Resistance	(4 Hr. Contact) – Slight Softening (Recovers).
30% Sulfuric Acid	(65 Hr. Contact) – No Effect
20% Sodium Hydroxide	(65 Hr. Contact) – Dulls (168 Hr. Contact) dulling and some adhesion loss.
5% Salt Spray	(1000 Hr.) – 1/8" creep
Weather-O-Meter	(1000 Hr.) 10 – 25% Gloss Loss

2.02 FINISHES

- A. Refer to schedule in this Section for surface finishes.

PART 3 EXECUTION

3.01 COLORS AND SCHEDULING

- A. Secure approval of color samples before ordering any paint or finish materials. Priming coats and undercoats shall be tinted to approximate shade of final coat. Furnish schedule showing when respective coats of paint for various areas and surfaces are to be applied. Keep schedule current as job progress dictates. If Exhibit Designer so directs, succeeding coats shall not be applied until he has had opportunity to inspect completed coat.

3.02 PREPARATION

A. Painted Surfaces

1. Protect items not to be painted or remove prior to painting. If required to be removed, reposition after painting.
2. Make any wood surfaces to be painted clean, smooth, dry and fully sanded. Knots and pitch pockets under Paint Finish shall be sealed with Shellac. Fill joints, cracks, nail holes, disfigurements, etc. with putty after priming; then sand smooth.

B. Galvanized Metal

1. Make any exposed steel items clean, free of rust, dust, grease, dirt or any foreign debris. Remove any mill scale or rust with light sandblasting as required by manufacturers suggestion. Follow proper priming and galvanizing application requirements as specified by manufacturer.

3.03 PROTECTION

- A. Protect not only painted surfaces at all times, but also protect adjacent work and materials by suitable covering or other method during progress of work. Upon completion of work remove all paint and varnish spots from floors, glass and other surfaces not indicated to be painted. Remove from premises rubbish and accumulated materials of whatever nature not caused by

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other and leave work in clean, orderly and acceptable condition. Remove and protect hardware, accessories, device plates, lighting fixtures, factory finished work and similar items. Upon completion of each space, carefully replace all removed items. This work shall be done only by skilled mechanics, using adequate tools commensurate with work to be done. Remove electrical panel box covers and doors before painting wall. Paint separately and reinstall after all paint is dry.

3.04 APPLICATION

A. Painted Surfaces

1. Apply materials evenly spread and smoothly flowed on with type and sizes of brushes, roller covers, bucket grids and spray equipment required to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple. Paint shall be applied in number of coats specified and at manufacturer's recommended dry film thickness or thicker. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, cover surface with additional coats until paint film is uniform finish, color appearance and coverage. This shall be done at no additional cost to Owner. Coats shall be thoroughly dry before application of succeeding coats. Enamel or varnish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even, smooth finish.
2. Back Priming: In addition to priming and finishing coats herein specified, back prime concealed surfaces of plywood, millwork and ungalvanized metal items with 1 coat specified primer.

B. Powder Coating or Galvanized

1. Prepare Surfaces and apply coatings in strict accordance with manufacturer's instructions.
2. Should any coating be unsatisfactory, it shall be corrected or removed, and additional coats be applied as necessary until satisfactory finish is achieved.

END OF SECTION

SECTION 06 0140

WOOD RESTORATION AND CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes cleaning, repair, and replication of the following existing wood elements as indicated on Drawings:
 - 1. Repairing wood paneling, built-in shelving, columns, casework, railings and trim.
 - 2. Repairing, refinishing, and replacing hardware.
- B. Related Requirements:
 - 1. Section 08 0350 "Restoration of Wood Windows".

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to wood repair, including, but not limited to, the following:
 - a. Materials, material application, sequencing, tolerances, and required clearances.
 - b. Fire-protection plan.
 - c. Coordination with building occupants.

1.3 SEQUENCING AND SCHEDULING

- A. Perform wood repair in the following sequence, which includes work specified in this and other Sections:
 - 1. Clean surfaces.
 - 2. General Wood-Repair Sequence:
 - a. Remove paint to bare wood.
 - b. Repair wood by consolidation, replacement, partial replacement, and patching.
 - c. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
 - 3. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
 - 4. Reinstall components.
 - 5. Apply finish coats.
 - 6. Install remaining hardware.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 4. Chain-of-Custody Qualification Data: For manufacturer and vendor.

5. **Product Data:** Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 6. **Product Data:** For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 7. **Product Data:** For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 8. **Product Data:** Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 9. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. 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, joinery, reinforcing, method of splicing or attaching wood members to other surfaces, accessory items, and finishes.
 2. Include field-verified dimensions and the following:
 - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relationship of existing components to new components.
 - b. Templates and directions for installing hardware and anchorages.
 - c. Identification of each new unit and its corresponding location in the building on annotated plans and elevations.
 - d. Provisions for sealant joints and flashing as required for location.
- D. Samples for Initial Selection: For each type of exposed wood and finish.
1. Identify wood species, cut, and other features.
 2. Include Samples of hardware and accessories involving color selection.
- E. Samples for Verification: Actual sample of finished products for the following products in manufacturer's standard sizes unless otherwise indicated:
1. Replacement Wood: 12-inch-long, full-size molding sections with applied finish.
 - a. Additional Samples of replacement members that show fabrication techniques, materials, and finishes as requested by Architect.
 2. Repaired Wood: Prepare Samples using existing wood removed from site, repaired, and prepared for refinishing.
 3. Refinished Wood: Prepare Samples using existing wood removed from site, repaired, and refinished.
 4. Hardware: Full-size units with each factory-applied or restored finish.
- 1.5 QUALITY ASSURANCE
- A. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar wood-treatment

applications with successful results, and with factory-authorized service representatives who are available for consultation, Project-site inspection, and on-site assistance.

1.6 MOCKUPS

- A. Prepare mockups of treatment repair processes to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation. Prepare mockups so they are inconspicuous.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 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. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.
- B. Until installed, store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 WOOD REPAIR QUALITY STANDARD

- A. Quality Standard: Comply with applicable requirements in Section 12, " Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.
 - 1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. **Building Product Disclosure Requirements:** Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:

- a. Embodied Carbon (GWP) Baselines: Wood
 - 1) Dimension Lumber – 100 kg CO₂eq per m³/ 80 kg CO₂eq per yd³
 - a) Wood Framing
 - 2) Composite Lumber – 400 kg CO₂eq per m³/ 310 kg CO₂eq per yd³
 - b. System Boundary: Product Stage A1-A3.
 - c. Declared Units: 1 meter or 1 cubic meter/ 1 foot or cubic yard.
 - d. Product Category Rules:
 - 1) ASTM International PCR for North American Pressure-treated Wood Products, v.1, 2016-06-29
 - 2) SCS Global Services PCR for Roundwood, v.1, 2016-10-18
 - 3) Institut Bauen und Umwelt e.V. PCR for Wood based panels, v.1.0/1.7/1.1, 2019-01-07.
 - 4) UL Environment PCR for North American Structural and Architectural Wood Products, v.1, 2019-10-21.
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
- 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Paints and Coatings:
- 1. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”
- F. Additional Low-emitting requirements – Adhesives and Sealants:
- 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.
- G. Low-emitting requirements – Composite Wood:
- 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- H. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- I. Additional Low-emitting requirements – Thermal and Acoustic Insulation
- 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.
- J. Sustainability Requirements:
- 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 REPLICATED WOOD ITEMS

- A. Replicated Wood wood paneling, built-in shelving, columns, railings and trim: Custom-fabricated replacement wood units and components, with operating and latching hardware.
 - 1. Joint Construction: Joints matching existing joints.
 - 2. Wood Species: Match species of existing wood.
 - 3. Wood Cut: Match cut of existing wood.
 - 4. Wood Member and Trim Profiles: Match profiles and detail of existing.

2.3 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
 - 1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.
- B. Wood paneling, built-in shelving, columns, railings and trim: Match existing species or provide Douglas fir.
- C. Exterior Trim: Match existing species.
- D. Interior Trim: Match existing species.

2.4 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
- C. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound must be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound must be capable of filling deep holes and spreading to featheredge.

2.5 HARDWARE

- A. Hardware, General: Provide hardware required for each type of replicated or repaired wood, including, but not limited to, hinges, pulls, latches, fasteners, and accessories indicated or required for proper operation. Hardware must smoothly operate, tightly close, and secure units appropriately for frequency of use, unit weight, and dimensions.
- B. Replacement Hardware: Replace existing damaged or missing hardware with new hardware manufactured by one of the following:
- C. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated by the following:
 - 1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.

2.6 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage caused by fungi and wood-boring insects; containing no boric acid.
- B. Cleaning Materials:
 - 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
- C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 - 2. Use concealed fasteners for interconnecting wood components.
 - 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
 - 4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
 - 5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 - 6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

2.7 WOOD FINISHES

- A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent materials from damage by wood repair.
- B. Clean wood of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 WOOD REPAIR, GENERAL

- A. Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from 5 ft. away for interior work and from 20 ft. away for exterior work.
- B. General: In treating items, disturb them as minimally as possible and as follows:
 - 1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.

2. Remove coatings and apply borate preservative treatment before repair.
 3. Repair items in place where possible.
 4. Install temporary protective measures to protect wood-treatment work that is indicated to be completed later.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods, such as sanding, wire brushing, or power tools, except as indicated as part of the treatment program and as approved by Architect.
- D. Repair and Refinish Existing Hardware: Dismantle hardware; strip paint, repair, and refinish it to match finish samples; and lubricate moving parts just enough to function smoothly.
- E. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.
1. Unless otherwise indicated, repair wood by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 2. Where indicated, repair wood by limited replacement matching existing material.
- F. Replace Wood: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
1. Do not use substitute materials unless otherwise indicated.
 2. Compatible substitute materials may be used.
- G. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location. Key items to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.3 WOOD PATCH-TYPE REPAIR

- A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.
1. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
 2. Treat wood with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
 3. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
 3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
 4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

5. Clean spilled compound from adjacent materials immediately.

3.4 WOOD-REPLACEMENT REPAIR

- A. General: Replace parts of or entire wood items at locations indicated on Drawings and where damage is too extensive to patch.
 1. Remove surface-attached items from wood surface before performing wood-replacement repairs unless otherwise indicated.
 2. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
 3. Remove broken, rotted, and decayed wood down to sound wood.
 4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
 5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Reinstall items removed for repair into original locations.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage wood-repair-material manufacturers' factory-authorized service representatives for consultation and Project-site inspection, and provide on-site assistance when requested by Architect.

3.6 ADJUSTMENT

- A. Adjust existing and replacement operating items, hardware, and accessories for a tight fit at contact points and for smooth operation and tight closure. Lubricate hardware and moving parts.

3.7 CLEANING AND PROTECTION

- A. Protect wood surfaces from contact with contaminating substances resulting from construction operations. Monitor wood surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact wood surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after wood repair. Avoid damage to coatings and finishes. Remove excess sealants, patching materials, dirt, and other substances.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking, cants, and nailers.
 - 3. Wood furring and grounds.
 - 4. Wood sleepers.
 - 5. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing."

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 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.
- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
5. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.

1.6 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 and is a certified participant in AWI's Quality Certification Program.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 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. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- C. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.
- D. Low-emitting requirements – Composite Wood:
 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- E. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- F. 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. Provide dressed lumber, S4S, unless otherwise indicated.
- G. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry 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 or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. 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, 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 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 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 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. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- 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 testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. Roof framing and blocking.
 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

2.4 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.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine or southern pine; SPIB.
 - 3. Spruce-pine-fir; NLGA.
 - 4. Hem-fir; WCLIB or WWPA.
 - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - 6. Northern species; NLGA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Eastern softwoods, No. 3 Common grade; NELMA.
 - 4. Northern species, No. 3 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.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002, 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 or ICC-ES AC193 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Where required for compatibility with wood treatment:
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
- F. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Where required for compatibility with wood treatment:
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cleveland Steel Specialty Co.
 - 2. KC Metals Products, Inc.
 - 3. Phoenix Metal Products, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 2. Basis of Design: Subject to compliance with requirements, provide Titebond Original wood glue by Franklin International or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- 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.
- C. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

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 to other construction; scribe and cope as needed for accurate fit. 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. Metal Framing Anchors: 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 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 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 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 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. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics will 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. 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 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 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 Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches 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 11 00
WOOD FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections (if included in project), apply to this Section.

1.02 SUMMARY

- A. Section includes framing lumber, plywood, and engineered lumber products

1.03 REFERENCES

- A. General:
 - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
 - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- B. American Forest Products Association
 - 1. National Design Specification (NDS) for Wood Construction
- C. American Plywood Association
 - 1. Plywood Design Specification (PDS)
- D. American Institute of Timber Construction
 - 1. Timber Construction Manual (TCM)
 - 2. AITC 106 Code of Standard Practice
 - 3. AITC 190.1 American National Standard, Structural Glued Laminated Timber

1.04 DEFINITIONS

- A. Dimension Lumber: Lumber of 2" nominal or greater but less than 5" nominal in the least dimension
- B. Timber: Lumber of 5" nominal or greater in the least dimension

1.05 ACTION SUBMITTALS

- A. 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.
- B. 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.

- C. 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.
- D. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- E. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- F. Engineered lumber product data including allowable design values

1.06 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.

1.07 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

2.01 FRAMING LUMBER

- A. Southern Yellow Pine grade marked and kiln dried, S4S, No. 2, maximum moisture content 19% unless noted otherwise on the Drawings.
 - 1. 1. Kiln dried to 15% for any framing members called out to be painted.
- B. All lumber in contact with masonry or exposed to earth or weather, including sill plates, shall be pressure treated with AWPAC Standard U1 and the Use Category listed on the drawings.
- C. Treatment shall be CCA for timber piles or MCA for dimensional lumber to a minimum retention of 0.40 lbs/cubic foot in accordance with AWPAC. ACQ treatment is not allowed without written approval of the structural engineer.
- D. All field cut ends of preservative treated lumber not scheduled to receive another finish shall receive a water-repellent preservative.

2.02 PLYWOOD SHEATHING

- A. All plywood sheathing shall comply with APA as follows and have exterior glue.
 - 1. Floor Sheathing: APA rated 48/24, 23/32" (3/4" nominal) thick.
 - 2. Roof Sheathing: APA rated 32/16, 19/32" (5/8" nominal) thick.
 - 3. Wall Sheathing: APA rated 32/16, 15/32" (1/2" nominal) thick.
- B. For fastening patterns to supports, see Drawings.
- C. All plywood shall be treated and have exterior glue.
- D. OSB will not be accepted as a substitution for plywood without approval by the Architect.

2.03 ENGINEERED LUMBER PRODUCTS

- A. Laminated Veneer Lumber (LVL) - All members designated as "LVL" shall be laminated veneer lumber having properties and strength equal to Trus Joist "Microllam" with a minimum designated modulus of elasticity of 2000 ksi (2.0E) for all headers and beams. LVL members shall be glued and nailed together following the manufacturer's instructions.
- B. Parallel Strand Lumber (PSL) - All members designated as "PSL" or "PSL Plus" shall be parallel strand lumber having properties and strength equal to Trus Joist "Parallam" with a minimum designated modulus of elasticity of 2000 ksi (2.0E) for all headers and beams. Members exposed to weather shall be "Parallam Plus" members with a minimum Service Level II pressure treatment by the manufacturer.

2.04 CONNECTIONS

- A. All connection bolts for wood framing members shall be minimum 3/4"Ø ASTM A307 bolts.
- B. All bolts and lag bolts shall be fitted with galvanized, malleable iron or steel plate washers.
- C. All hangers, clips, connectors, anchors, ties, etc. shall be attached with nails of the maximum size and type recommended by the manufacturer. All holes in connectors shall be filled.
- D. All treated wood members shall be connected or fastened with galvanized hangers, nails, screws, bolts, and all other accessories. The coating must be hot-dipped to an equivalent of G-90 rating or greater.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means Contractor accepts that existing conditions meet the requirements for installation.

3.02 EXECUTION

- A. Comply with provisions of IBC, latest edition, including recommended fastening schedule and minimum bracing, except where exceeded by requirements of the contract documents.
- B. All member piece ends, joints, or splices shall be over supports unless noted otherwise.
- C. Unless noted otherwise, multiple pieces of dimensional lumber used to form beam or header members shall be attached together with 4 rows of 16d nails spaced at 16" for pieces up to 12" deep, 5 rows of 16d nails at 16" for pieces 14" and 16" deep and 6 rows of 16d nails spaced at 16" for pieces 18" deep (respectively).
- D. Unless noted otherwise, multiple pieces of engineered lumber shall be fastened together per provided fastening schedule and in accordance with manufacturer requirements.
- E. All multiple studs for jambs for wood framed openings shall be connected with 2 rows of 12d nails at 8" o.c.
- F. Load-bearing wall framing is based on the final condition of the structure with the sheathing providing bracing. Contractor shall provide temporary bracing of load-bearing studs as required

during construction that will reproduce the effect of sheathing. Temporary bracing is the responsibility of the Contractor and therefore at the discretion of the Contractor.

- G. See Drawings for header and jack stud requirements.
- H. Members shall be set with crown up and have a minimum of 3 inches bearing.
- I. Splice double sole plates directly over stud. Stagger splice of each plate.
- J. Provide solid wood blocking or diagonal bridging for dimensioned lumber floor joists at intervals not exceeding 8'-0" o.c. max during construction. Blocking shall remain.
- K. All plywood wall sheathing shall have solid blocking at all horizontal joints.
- L. Vertical joints of plywood roof sheathing shall be staggered every four feet or less
- M. All load-bearing dimensional lumber walls shall have solid blocking at a maximum interval of 4ft o.c. during construction. Blocking shall remain.
- N. Load-bearing wall framing is based on the final condition of the structure with the sheathing providing bracing. Contractor shall provide temporary bracing of load-bearing studs as required during construction that will reproduce the effect of sheathing. Temporary bracing is the responsibility of the Contractor and therefore at the discretion of the Contractor.

END OF SECTION 06 11 00

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Parapet sheathing.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 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.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 - 4. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 5. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

6. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For following products, from ICC-ES:
 1. Preservative-treated plywood.
 2. Fire-retardant-treated plywood.
 3. Foam-plastic sheathing.

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 and is a certified participant in AWI's Quality Certification Program.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Mockups: Install sheathing 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.

1.6 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.

- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is in lowest 60th percentile of the most recent Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines as found on EC3 as found on EC3 and as listed below for reference:
 - a. Embodied Carbon (GWP) Baselines: Wood
 - 1) Sheathing – 230 kg CO₂eq per m³ CO₂eq per yd³
 - b. Embodied Carbon (GWP) Baselines: Glass Mat Panels
 - 1) Sheathing – 5/8" – 504 kg CO₂eq per 1003 ft² CO₂eq per yd³
 - c. System Boundary: Product Stage A1-A3.
 - d. Declared Units: 1 meter or 1 cubic meter/ 1 foot or cubic yard.
 - e. Product Category Rules:
 - 1) Institut Bauen und Umwelt e.V. PCR for Wood based panels, v.1.0/1.7/1.1, 2019-01-07.
 - 2) ASTM International PCR for North American Glass Mat Gypsum Panels, v.1, 2016-08-01.
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- F. Low-emitting requirements – Composite Wood:
1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- G. Certified Wood: Wood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- H. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. 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.
 - 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 or used with roofing, flashing, vapor barriers, and waterproofing.

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 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 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 - 1. Roof and wall sheathing within 48 inches of fire walls.
 - 2. Roof sheathing as indicated.

2.5 WALL SHEATHING

- A. Plywood Wall Sheathing: Either DOC PS 1, Exterior sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: as indicated on drawings.
- B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond eXP.
 - d. United States Gypsum Co.; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.6 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exterior, Structural sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: as indicated on drawings.

2.7 PARAPET SHEATHING

- A. Plywood Sheathing: DOC PS 1, sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: as indicated on drawings.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- 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.
 - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- 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, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.

2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 9200 "Joint Sealants."
- B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to 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.

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. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 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 Roof Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 GLASS MAT SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 - 2. For sheathing under stucco cladding, boards 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. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion 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.
- E. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing:
 - 1. Install accessory materials according to sheathing manufacturer's written instructions and details to form a seal with adjacent construction, to seal fasteners, and ensure continuity of air and water barrier.
 - a. Coordinate the installation of sheathing with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - b. Install transition strip on roofing membrane or base flashing, so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 2. Connect and seal sheathing material continuously to air barriers specified under other Sections as well as to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - 3. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
 - 4. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion, so that a minimum of 3 inches

of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

- a. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
5. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with foam sealant.
6. Seal top of through-wall flashings to sheathing with an additional 6-inch-wide, transition strip.
7. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
8. Repair punctures, voids, and deficient lapped seams in strips and transition strips extending 6 inches beyond repaired areas in strip direction.

END OF SECTION

SECTION 06 2013

EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior wood trim.
 - 2. Exterior wood trellis.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - 2. Section 06 1533 "Wood Decking" for elevated decks.
 - 3. Section 09 9113 "Exterior Painting" for priming and backpriming of exterior finish carpentry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 1. Include data for wood-preserved 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. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 - 4. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 5. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 6. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

7. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - C. Shop drawings: for any situations with exposed fasteners, provide fastener layout for review and approval.
 - D. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.
 - E. Samples for Verification:
 1. For each species and cut of lumber and panel products, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
 2. 3 - 24 inch long samples of specified FSC Certified wood with representative finish showing full range of color and finish to be expected.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Compliance Certificates:
 1. For lumber that is not marked with grade stamp.
 2. For preservative-treated wood that is not marked with treatment-quality mark.
 3. For fire-retardant-treated wood that is not marked with classification marking of testing and inspecting agency.
 - B. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 - C. Sample Warranties: For manufacturer's warranties.
- 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.
 - A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
 - B. 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, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 2. Provide for air circulation around stacks and under coverings.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- D. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Low-emitting requirements – Composite Wood:
 - 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- F. Certified Wood: Wood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- G. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- H. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece.

I. Softwood Plywood: DOC PS 1.

J. Hardboard: ANSI A135.4.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Water-Repellent Preservative Treatment by Nonpressure Process: AWP A N1; dip, spray, flood, or vacuum-pressure treatment.
1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chlorpyrifos (CPF).
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 3. Do not use CCA products or products that contain arsenic.
 4. Application: where indicated.
- B. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3b.
1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 4. Do not use material that is warped or does not comply with requirements for untreated material.
 5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
 6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
 7. Application: Where indicated on Drawings.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing 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, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Exterior Type: Materials shall comply with testing requirements after being subjected to accelerated weathering according to ASTM D 2898.

2. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.
- D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
- E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
 2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
- F. Application: Where indicated.

2.4 EXTERIOR TRIM

- A. Lumber Trim for Semitransparent-Stained Finish:
 1. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA Clear Heart VG (Vertical Grain).
 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).
- B. Lumber Trim for Painted Finish:
 1. Species and Grade: Hem-fir; NLGA, WCLIB, or WWPA Prime or D finish.
 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).

2.5 EXTERIOR TRELLIS

- A. Provide framing and slats as indicated on drawings.
- B. Lumber Trim for Semitransparent-Stained Finish:
 1. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA Clear Heart VG (Vertical Grain).
 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).
- C. Lumber Trim for Painted Finish:
 1. Species and Grade: Hem-fir; NLGA, WCLIB, or WWPA Prime or D finish.
 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. For applications not otherwise indicated, provide stainless steel fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Flashing: Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
- D. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and applicable requirements in Section 07 9200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.
 - 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. Tremco Incorporated; Tremflex 834.

2.7 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

2.8 FINISHES - EXTERIOR SIDING WOOD STAIN PRODUCTS

- A. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Effect: Semifilled finish.
 - 3. Sheen: Satin.
- B. Semitransparent Oil/Alkyd Stain: Factory-formulated oil- or oil/alkyd-resin-based semitransparent wood stain applied at spreading rate recommended by manufacturer.
 - 1. Two-coats Sikkens Cetol 1 #078 Natural and Two coats Sikkens 23 plus #078 Natural.
- C. Shop applied to front, back and sides of all boards
 - 1. Field brush on cuts and touch-up.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
 - 1. Cut to required lengths and prime ends.
 - 2. Comply with requirements in Section 09 9113 "Exterior Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
 - 3. Refinish and seal cuts as recommended by manufacturer.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
 - 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
 - 1. Use scarf joints for end-to-end joints.
 - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water.
 - 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
 - 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
 - 1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 06 4023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior standing and running trim.
 - 2. Wood wall and ceiling panels
 - 3. Closet and utility shelving.
 - 4. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
 - 5. Shop priming of interior architectural woodwork.
 - 6. Shop finishing of interior architectural woodwork.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
 - 2. Section 12 3600 "Countertops".

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Anchors.
 - 2. Adhesives.
 - 3. Shop finishing materials.
 - 4. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

5. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - B. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 4. Product Data: Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 5. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 6. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 7. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 8. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - C. Shop Drawings: For interior architectural woodwork.
 1. Include plans, elevations, sections, and attachment details.
 2. Show large-scale details.
 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 4. For paneling, Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - D. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.
 - E. Samples for Verification: For the following:
 1. Lumber for Transparent Finish: Not less than 5 inches wide by 24 inches long, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
 3. Veneer-faced panel products with or for transparent finish, 12 by 24 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
 4. Corner Pieces:
 - a. Miter joints for standing trim.
- 1.7 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For manufacturer and Installer.
 - B. Product Certificates: For each type of product including the following:

1. Composite wood and agrifiber products.
 2. Glass.
 3. Adhesives.
- C. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.
- D. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator and Manufacturer Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups of typical interior architectural woodwork 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.11 COORDINATION

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

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- F. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- G. Low-emitting requirements – Composite Wood:
 - 1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

- H. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- I. Additional Low-emitting requirements –Thermal and Acoustic Insulation
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.
- J. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Hardwood Lumber:
 - 1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
 - 2. Wood Moisture Content: 5 to 10 percent.
 - 3. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
 - 4. For base wider than available lumber, glue for width. Do not use veneered construction.
 - 5. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood or MDF where indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.

2.4 WOOD WALL AND CEILING PANELS – FLUSH WOOD PANELING

- A. Grade: Premium.
- B. Wood Species and Cut: White oak, rift sliced.
- C. Veneer Matching Method:
 - 1. Adjacent Veneer Leaves: Slip match.
 - 2. Within Panel Face: Balance match.
 - 3. Adjacent Veneer Leaves and within Panel Face: Slip, center-balance, or book match.
- D. Vertical Panel-Matching Method: Continuous end match; veneer leaves of upper panels are continuations of veneer leaves of lower panels.
- E. Panel Core Construction: Hardwood veneer-core plywood.
 - 1. Thickness: As indicated on Drawings.
 - 2. Finish: Transparent finish
- F. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.

2.5 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 - 2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
 - 1. **Recycled Content of MDF and Particleboard:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - a. Basis of Design: "Medite" 3/4 inch thick, by Roseburg.
 - 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - 4. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 5. Hardwood Veneer Plywood: HPVA HP-1, Non-toxic, urea formaldehyde free: with soy-based adhesive:
 - a. Basis of Design: Purebond by Columbia Forest Products Inc.
 - 6. Fire Rated Plywood FR plywood where noted: Either DOC PS 1 or DOC PS 2, Exposure 1 sheathing.
 - a. Nominal Thickness: Not less than 1 1/8 inches and as indicated.
 - 7. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.6 PRESERVATIVE-TREATED-WOOD MATERIALS

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWWPA N1 (dip, spray, flood, or vacuum-pressure treatment).
 - 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with a compatible EPA-registered insecticide.
 - 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.
 - 1. Items fabricated from the following wood species need not be treated:
 - a. Redwood.
 - b. Western red cedar.
 - c. White oak.
 - d. African mahogany.
 - e. Honduras mahogany.
 - f. Ipe.
 - g. Dark red meranti.
 - h. Teak.

2.7 FIRE-RETARDANT-TREATED WOOD MATERIALS

- A. Fire-Retardant-Treated Wood Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements 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.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
 3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Roseburg, Medite FR.

2.8 HARDWARE AND ACCESSORIES

- A. General: Provide hardware and accessory materials except for items specified in Section 08 7100 "Door Hardware."
- B. Adjustable Shelf Standards and Supports:
1. ANSI/BHMA A156.9, B04071; with shelf rests, B04081
 2. ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Color: Black.
 2. Acceptable manufacturer:
 - a. Doug Mockett & Co, Inc.
- E. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.
- F. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.9 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
 - 1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
 - a. Provide where in contact with concrete or masonry.
 - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
 - 2. Fire-Retardant Treatment: Complying with requirements; provide where indicated.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 1. Basis of Design: Subject to compliance with requirements, provide Titebond Original wood glue by Franklin International or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.10 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
 - 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."
 - 1. For glass in frames, secure glass with removable stops.
 - 2. For exposed glass edges, polish and grind smooth.
- F. Core Material:

1. Horizontal surfaces: All hardwood veneer core plywood
2. Vertical Surfaces: All hardwood veneer core plywood or MDF 40 at Contractor's option.
3. Vertical Surface with flame spread requirements: Fire-Retardant Fiberboard.
4. Doors: Provide solid bearing for hinges.

2.11 SHOP PRIMING

- A. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 9123 "Interior Painting."
- B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.12 SHOP FINISHING

- A. General: Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
 1. Grade: Same as item to be finished.
 2. Finish: System - 2, precatalyzed lacquer 3, postcatalyzed lacquer or 5, conversion varnish.
 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 4. Staining: Match Architect's sample.
 5. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.

- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWWPA M4.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 - 3. For shop-finished items, use filler matching finish of items being installed.
- H. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 - 2. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
 - 3. Scarf running joints and stagger in adjacent and related members.
 - 4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
 - 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 INSTALLATION – WALL AND CEILING PANELS

- A. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
- B. Anchor paneling to supporting substrate with blind nailing.
 - 1. Do not use face fastening unless covered by trim.
- C. Anchor Modular Wall Panels to supporting substrate with concealed panel-hanger clips.
- D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
- E. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed paneling.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.4 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.
- B. Clean, lubricate, and adjust hardware.

END OF SECTION

SECTION 06 6400

PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plastic sheet paneling.
 - 2. Factory-laminated plastic sheet paneling.
- B. Related Requirements:
 - 1. Section 06 1000 "Rough Carpentry" for wood furring for installing plastic paneling.
 - 2. Section 10 2600 "Wall and Door Protection" for corner guards installed over plastic paneling.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 CLOSEOUT SUBMITTALS

- A. Care and Maintenance Instructions: Submit manufacturer's care and maintenance instructions, including cleaning and repairing instructions.
- B. Warranty Documentation: Submit manufacturer's standard warranty.
- C. Extra Stock Materials:
 - 1. Deliver to Owner extra stock materials from same production run as products installed.
 - 2. Quantity: Furnish quantity of FRP panels equal to 5 percent of amount installed.

3. Delivery, Storage, and Protection:
 - a. Comply with Owner's requirements for delivery, storage, and protection of extra stock materials.
 - b. Package extra stock materials with protective covering and include labels clearly identifying product name and manufacturer.

1.5 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.
- B. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of FRP panels of similar type to that specified.
- C. Installer's Qualifications:
 1. Installer regularly engaged, for a minimum of 5 years, in installation of FRP panels of similar type to that specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 1. Store and handle materials in accordance with manufacturer's instructions.
 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 3. Store materials in clean, dry area indoors at temperature and humidity conditions in accordance with manufacturer's instructions.
 4. Store materials on flat, level surface, raised above floor, with adequate support to prevent sagging.
 5. Store materials out of direct sunlight.
 6. Protect materials and finish during storage, handling, and installation to prevent damage.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.

1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

D. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

E. Additional Low-emitting requirements – Adhesives and Sealants:

1. Do not use adhesives that contain urea formaldehyde.
2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.

F. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 PLASTIC SHEET PANELING – PVC FREE

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.

1. Products Subject to compliance with requirements, provide one of the following:
 - a. Paladium rigid sheets by InPro
 - b. Panolam FRP by Panolam.
 - c. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 200 or less.
 - b. Smoke-Developed Index: 450 or less.
3. Nominal Thickness: Not less than 0.09 inch.
4. Surface Finish: As selected by Architect from manufacturer's full range.
5. Color: as indicated on the drawings.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: As selected by Architect from manufacturer's full range.

- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

- D. Adhesive: As recommended by plastic paneling manufacturer.

- E. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone or Latex sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 06 74 13
FIBERGLASS REINFORCED GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced-plastic gratings.

1.3 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For glass-fiber-reinforced-plastic gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. All American Grating.

2. American Grating, LLC.
3. BarnettBates Corporation.
4. Creative Pultrusions, Inc.
5. Enduro; Composite Products Division.
6. Fibergrate Composite Structures Inc.
7. Fisher & Ludlow; a Nucor company.
8. Grating Pacific, Inc.
9. Seasafe, Inc.; a Gibraltar Industries company.
10. Strongwell Corporation.

2.2 GLASS-FIBER-REINFORCED-PLASTIC GRATINGS

- A. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.
1. Grating Size: As indicated on drawings.
 2. Resin:
 - a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - b. USDA Acceptance: Accepted for food-processing applications.
 3. Color: Gray.
 4. Grit: As indicated on drawings

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners. Select fasteners for type, grade, and class required.

2.4 FABRICATION

- A. Shop Assembly: Shop fabricate grating sections to greatest extent possible to minimize field splicing and assembly. 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 material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form gratings from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Provide for anchorage of type indicated, coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

- F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- G. Special Instructions for Animal Areas: Gratings may be in contact with animals and act as part of the primary animal enclosure. All gaps between grating panels or adjacent framing shall not exceed gaps shown on drawings. No sharp cut edges are allowed in animal areas. Ease or cover cut edges as indicated in drawings and directed by Architect in field.

2.5 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Glass-Fiber-Reinforced-Plastic Gratings: As indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings 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 gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.

3.2 INSTALLING GLASS-FIBER-REINFORCED-PLASTIC GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.
- B. See drawings for additional fastening requirements in animal areas.

END OF SECTION 06 74 13

SECTION 07 0150

PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Full roof tear-off of roof areas indicated on Drawings.
 - 2. Re-cover preparation of roof areas indicated on Drawings.
 - 3. Removal of flashings and counterflashings.
 - 4. Temporary roofing.

1.3 DEFINITIONS

- A. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck.
- B. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- C. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing 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 tear-off, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring Architect notification.
 - f. Existing roof deck removal procedures and Owner notifications.
 - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - h. Structural loading limitations of roof deck during reroofing.
 - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - j. HVAC shutdown and sealing of air intakes.
 - k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.

- l. Asbestos removal and discovery of asbestos-containing materials.
- m. Governing regulations and requirements for insurance and certificates if applicable.
- n. Existing conditions that may require Architect notification before proceeding.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Temporary Roofing Submittal: Product data and description of temporary roofing system.
 - 1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind or specified special warranty.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.
 - 1. Submit before Work begins.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of three years' experience installing products similar to those specified, able to communicate verbally with Contractor, Architect, and employees, and the following:
 - 1. Qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.
- B. Regulatory Requirements:
 - 1. Comply with governing EPA notification regulations before beginning roofing removal.
 - 2. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 3.

1.8 FIELD CONDITIONS

- A. Existing Roofing System: SBS-modified bituminous roofing.
- B. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

1. Remove only as much roofing in one day as can be made watertight in the same day.
- F. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
 1. Hazardous materials will be removed by Owner before start of the Work.
 2. Existing roof will be left no less watertight than before removal.
 3. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
 - a. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

- A. Plywood: DOC PS 1, Grade CD, Exposure 1.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.

2.3 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
 1. Infill materials are specified in Section 07 5423 Thermoplastic Polyolefin (TPO) Roofing " unless otherwise indicated.
- B. Wood blocking, curbs, and nailers are specified in Section 06 1053 Miscellaneous Rough Carpentry."
- C. Roof sheathing is specified in Section 06 1600 "Sheathing."
- D. Fasteners: Factory-coated steel fasteners with metal or plastic plates acceptable to new roofing system manufacturer.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 1. Protect existing roofing system that is not to be reroofed.
 2. Loosely lay 1-inch-minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
 - a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.
 3. Limit traffic and material storage to areas of existing roofing that have been protected.
 4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
 5. Comply with requirements of existing roof system manufacturer's warranty requirements.

- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
- D. Test existing roof drains to verify that they are not blocked or restricted.
 - 1. Immediately notify Architect of any blockages or restrictions.
- E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
 - 1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
 - 1. Prevent debris from entering or blocking roof drains and conductors.
 - a. Use roof-drain plugs specifically designed for this purpose.
 - b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
 - a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

- A. Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Full Roof Tear-off: Where indicated on Drawings, remove existing roofing and other roofing system components down to the existing roof deck.
 - 1. Remove vapor retarder roof insulation and cover board.
 - 2. Remove base flashings and counter flashings.
 - 3. Remove perimeter edge flashing and gravel stops.
 - 4. Remove copings.
 - 5. Remove expansion-joint covers.
 - 6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
 - 7. Remove roof drains indicated on Drawings to be removed.
 - 8. Remove wood blocking, curbs, and nailers.
 - 9. Remove excess asphalt from steel deck.
 - a. A maximum of 15 lb/100 sq. ft. of asphalt is permitted to remain on steel decks.
 - 10. Remove fasteners from deck.

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
 - 1. Do not proceed with installation until directed by Architect.

- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
 - 1. Do not proceed with installation until directed by Architect.

3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.
 - 1. Installation of infill materials is specified in Section 07 5216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing."
 - 2. Installation of wood blocking, curbs, and nailers is specified in Section 06 1053 Miscellaneous Rough Carpentry."
- B. Install new roofing patch over roof infill area.
 - 1. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.
- B. Remove temporary roofing before installing new roofing.
- C. Prepare temporary roof to receive new roofing according to approved temporary roofing proposal.
 - 1. Restore temporary roofing to watertight condition.
 - 2. Obtain approval for temporary roof substrate from roofing manufacturer and Architect before installing new roof.

3.6 BASE FLASHING REMOVAL

- A. Remove existing base flashings.
 - 1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain.
 - 1. Replace metal counterflashings damaged during removal with counterflashings specified in Section 07 6200 "Sheet Metal Flashing and Trim."
- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.
 - 1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.7 DISPOSAL

- A. Collect demolished materials and place in containers.
 - 1. Promptly dispose of demolished materials.
 - 2. Do not allow demolished materials to accumulate on-site.
 - 3. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

SECTION 07 0810

BUILDING AIRTIGHTNESS REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Administration and Coordination of Air Barrier System (ABS) Installation.
 - 2. Building Airtightness Testing & Inspection.

1.2 RELATED REQUIREMENTS

- A. Division 01 Section "Quality Requirements" for administrative and procedural requirements of testing and inspections.
- B. Division 07 Sections for air-barrier materials and specific quality control requirements for individual construction activities.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. The installed ABS shall conform to the following requirements:
 - 1. Building Air Leakage Rate: The air leakage rate of the building exterior envelope shall not exceed 0.25 cfm/ft² at a pressure differential of 0.3" w.g. (1.57 psf or 75 Pa) in accordance with ASTM E779-03.
 - 2. ABS must be continuous, with all joints made air and water tight.
 - 3. Structural Integrity: ABS shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.
 - 4. ABS shall not displace adjacent materials under full load.
 - 5. ABS shall be joined in an air-tight, watertight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep.

1.5 REFERENCES

- A. ASTM International (ASTM)
 - 1. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
 - 2. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - 3. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.
 - 4. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- B. International Organization For Standardization (ISO)

1. ISO 6781 - Thermal Insulation - Qualitative Detection of Thermal Irregularities in Building Envelopes Infrared Method, First Edition.

1.6 SUBMITTALS

- A. Qualification Data: Submit the qualifications of the building airtightness testing firm and include the following:
 1. List of the last 5 airtightness testing projects conducted including names and contact information of the clients.
 2. Provide copies of reports on the last 3 building airtightness tests performed.
 3. List of references with contact information and relationship.
 4. Listing of each piece of equipment, including manufacturer, model number, date of last certification.
- B. Test Report(s): Submit not later than 10 days after each test.
 1. Report Data: Written reports of each inspection and test or similar service shall include all the Report items described in ASTM E1827. Additionally, the report shall also include the following information:
 - a. Date of Issue
 - b. Project title and number
 - c. Name, address, and telephone number of testing agency
 - d. Dates and locations of samples and tests or inspections
 - e. Names of individuals making the inspection or test
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section
 - h. Complete inspection or test data
 - i. Test results and an interpretation of test results
 - j. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
 - k. Name and signature of test technician
 - l. Recommendations on retesting

1.7 QUALITY ASSURANCE

- A. Airtightness Testing Firm & Equipment:
 1. The testing firm shall have documented experience accomplishing air barrier performance testing using fan pressurization methods in accordance with ASTM E779 and E1827 on building of similar size, construction and complexity.
 - a. Demonstrate a thorough working knowledge and understanding of building construction, and in particular exterior envelope systems and HVAC systems.
 - b. Be experienced in diagnostic evaluation of the air barrier performance in accordance with ASTM E1186.
 - c. Thermographer: Meet the following minimum requirements:
 - 1) Level I or Level II Thermographer with education and thermography work experience and having completed application specific training for the use of IR thermography in Building Science.
 - 2) The thermographer must have the following abilities as developed through both training and experience:
 - 3) A thorough knowledge of the operation of the particular infrared imaging system being used.
 - 4) The ability to interpret thermograms and other data used in air barrier testing.
 - 5) The ability to confirm the test conditions are within set limits and are consistent with assumptions that support the interpretation.
 - d. Test Equipment:

- 1) Blower Fans: Calibrated units capable of both pressurizing and depressurizing the building at various different pressure levels to a maximum pressure of 75 Pa; units shall have been calibrated by an authorized calibration test facility within the previous 12 months.
- 2) Infrared Camera: The infrared imaging system must be radiometric with a minimum Noise Equivalent Temperature Difference (NETD), which is a measurement of thermal resolution or sensitivity, of less than 80mK at 25°C.
- 3) If temperatures are being measured, the parameters (i.e. emissivity, atmospheric temperature, etc.) need to be adjusted in the camera or by using software. Camera calibration records shall be available upon request.
- 4) The infrared imaging system must have an operating spectral range that falls between 2 and 14 micrometers (pm).
 - a) The imaging system must have a means of recording radiometric images seen on the camera's screen.
 - b) The camera's detector array must have no fewer than 320 x 240 pixels.

1.8 MOCK-UPS

- A. Field-Constructed Mock-Ups: Prior to start of Air Barrier System installation, construct
 1. mock-ups of each different Air Barrier System condition required for this project; use materials and installation methods/sequence that will be employed in the actual construction of the building.
 2. Apply air barrier on field-constructed mock-ups of assemblies specified in other Sections.
 - a. Construct typical wall and roof conditions, at least 8 feet long by 8 feet wide and 8 feet tall, at intersection of where new addition intersects with existing construction, incorporation the following:
 - b. Typical exterior wall framing and sheathing with parapet
 - c. Wall air barrier system
 - d. Exterior cladding materials
 - e. Roofing
 - f. Roof air barrier system
 - g. Window, louver and door frame and sill
 - h. Foam air barrier seal around windows, door and louvers
 - i. Insulation
 - j. Flashing
 - k. Building corner condition
 - l. Junction with roof system
 - m. Junction with foundation
 - n. Typical construction, control and expansion joints
 - o. Typical penetrations and gaps; illustrating materials interface and seals.
 - p. Typical penetrations by structural members, conduits, electrical boxes, pipes and ducts.
 - q. Typical penetrations by masonry ties, screws, bolts and similar.
- B. The mock-up shall demonstrate the proper installation sequence and workmanship required for the Air Barrier System installation to provide an air-tight envelope conforming to the Performance Requirements specified in this Section.
- C. Correct any non-conforming work as identified by Architect and testing agency; mock-ups confirming to requirements of Contract Documents shall become the standard of quality and construction for all subsequent similar conditions.

1.9 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Prior to starting installation of the ABS, convene a pre-installation conference at the job site to review the project conditions and installation requirements.
 - 1. Agenda shall include, at a minimum, construction of the mock-up, sequence of construction, substrate condition/preparation, materials approved for use, compatibility of materials, joint between the various different types of air barriers specified, coordination with installation of adjacent and covering materials, and details of construction.
 - 2. Attendance is required by installers of each of the various different air barriers specified and representatives of related trades including covering materials, substrate materials and adjacent materials.
 - 3. The manufacturer's technical representative for each different Air Barrier System specified in this Section shall attend the pre-installation conference and shall provide the following:
 - a. Inspect and approve (along with the installer) the mock-up and the substrate(s) to which the ABS will be installed.
 - b. Review and explain each air barrier system product, including its limitations, the required surface preparation, the environmental requirements and the installation instructions/procedures and requirements for each different substrate and air barrier product.

PART 2 - PRODUCTS

2.1 AIR BARRIER SYSTEM

- A. Provide materials and installation methods to bridge and provide an airtight connection/seal conforming to the Performance Requirements specified in this Section at the following air leakage pathways and gaps:
 - 1. Between the exterior wall air barriers and the roof air barrier.
 - 2. Between the exterior wall air barriers and the slab.
 - 3. Between different substrate materials/systems.
 - 4. Between the various different air barrier products/systems.
 - 5. At masonry control joints.
 - 6. Between the wall air barrier and window frames, storefront frames, etc.
 - 7. Between the wall air barrier and door frames.
 - 8. Between the air barrier and any penetrations, including penetrations by piping, conduit, duct, structural members and similar.
 - 9. Masonry ties, screws, bolts and similar penetrations.
 - 10. All other air leakage pathways in the building air barrier envelope.
- B. Individual air barrier materials include those specified in the following Sections:
 - 1. Division 07 Section "Foamed in Place Insulation."
 - 2. Division 07 Section "Modified Bituminous Sheet Air Barrier."
 - 3. Division 07 Section "Fluid-Applied Membrane Air Barriers."
 - 4. Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish and install the various different types of air barriers shown and specified to create an Air Barrier System (ABS) covering the entire building envelope constructed to perform as a continuous barrier that will remain adhered in place and durable for the life of the building.
 - 1. ABS shall accommodate movements of building materials by providing for airtight barrier across any building expansion and control joints that may be discovered but not represented on the drawings.

2. ABS shall accommodate changes in substrate and perimeter sealing conditions.
3. Different air barrier products shall be permanently joined together where they meet in a manner approved by both manufacturers to provide an airtight juncture.

3.2 FIELD QUALITY CONTROL

- A. Review the air barrier system installation in progress on a daily basis and confirm the following:
 1. Air barrier manufacturer's surface preparation and installation instructions are being followed.
 2. Temperature and site conditions conform to manufacturer's requirements.
 3. Site conditions for application temperature, and dryness of substrates are within guidelines.
 4. Continuity of the air barrier system over the entire building with no gaps and all penetrations are sealed allowing for no air infiltration or exfiltration through the air barrier system.
 5. Air barrier substrates are continuous and will structurally support the air barrier system to withstand design air pressures.
 6. Substrate surfaces are properly primed as recommended by manufacturer.
 7. Laps in materials conform to manufacturer's instructions and in no case are less than 3 inches and are shingle-lapped to shed water to exterior side.
 8. Mastic is applied on exposed edges of self-adhered membrane air barriers and elsewhere as recommended by manufacturer.
 9. Installer is using a roller to achieve/enhance adhesion of self-adhered membranes.
 10. Application thickness of liquid-applied materials over the entire surface conform with manufacturer's specifications for the specific substrate.
 11. Correct materials are installed for compatibility.
 12. Manufacturer recommended transitions are being employed for change in direction and structural support at gaps.
 13. Review connection between assemblies (membrane and sealants) for proper cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
 14. Air barrier system is not exposed to the weather longer than recommended by the barrier manufacturer.
 15. Test and record the bond strength of coatings and self-adhered membranes to substrate in accordance with ASTM D4541.

3.3 BUILDING AIRTIGHTNESS TEST

- A. A qualified testing firm shall conduct a test of the building for air tightness using calibrated portable blowers in accordance with ASTM E1827 or ASTM E779 and calculate the building air leakage rate. This test is intended to demonstrate that the building construction has produced an effective air barrier so that air infiltration and exfiltration through the exterior building envelope conform to performance requirements specified herein.
 1. The test shall be performed when the building envelope is enclosed and prior to the installation of finishes, including gypsum board.
 2. Notify the Architect at least 48 hours prior to the Building Air Tightness Test. A representative of the Architect will witness the test and record test readings.
 3. Prior to the test, submit evidence that the test equipment has been calibrated within the past two years.
 4. The measuring instruments used in the tests shall be digital meters, not analog gages. Tests shall be performed when the wind speed is less than 10 mph, and no rain.
 5. The following conditions will be observed in the building during the testing:
 - a. All exterior doors and windows shall be closed.
 - b. All interior doorways including stairway doors shall be open.
 - c. All HVAC systems shall be de-energized.
 - d. All appliances shall be de-energized.
 - e. All plumbing traps shall be full.

- f. Follow the Recommended Test Envelope conditions in ASTM E1827, Table 1, for the Closed Envelope condition.
- g. Test the building air leakage rate by pressurizing the building relative to the exterior environment at twelve pressures up to at least 0.30 inches water gauge (1.57 psf or 75 Pa) and record the results at each step in pressure increase.
- h. Test the building air leakage rate by depressurizing the building negatively relative to the exterior environment at twelve pressures up to at least -0.30 inches water gauge (1.57 psf or -75 Pa) and record the results; compare the results to the positive test.
 - 1) Where differences of 10% or more exist between the positive and negative pressure tests, investigate the causes and correct/resolve the reasons for the differences and then retest the building.
- i. If the building fails to meet the acceptable leakage rate specified under performance criteria herein, use techniques described in ASTM E1186 to locate the leak sources, then correct the deficiencies in the building construction, then retest.
 - 1) Any fog/smoke agents used to identify leaks shall be the non-toxic type.
- j. For each test, take a minimum of 12 readings at various pressures and air flows within the range of the calibrated equipment.
 - 1) In the test report, test points shall be shown in graphical form on a log-log scale with pressure in inches water column displayed on the horizontal axis and flow in cfm displayed on the vertical axis.
 - 2) The results of each test conducted shall be included in the report whether successful or not.

3.4 THERMOGRAPHY INSPECTION

- A. While the airtightness testing is being conducted and building is being positively or negatively pressurized, the building envelope shall be inspected by a qualified Thermographer using an infrared camera conforming to requirements specified herein.
 - 1. Any areas where evidence of air leakage is observed coming through the building envelope shall be noted and both standard and infrared photos taken to record the location/condition. Use smoke tracer to positively confirm sources of air leakage.
- B. Report: Include a summary of the areas/conditions where air leakage was observed in the building envelope along with the standard and infrared photo images taken.
- C. In the event that the building exceeds the specified air leakage rate, the building envelope shall be inspected by the Thermographer during each subsequent airtightness test that is conducted and shall be used to demonstrate and provide digital infrared photo record showing that the areas of air leakage have been corrected.

3.5 REPAIR AND PROTECTION

- A. Take measures to protect the air barrier system from damage during construction.
- B. Damaged air barriers shall be repaired as recommended by manufacturer by the air barrier installer prior to cover.
- C. After completion of the building and upon completion of inspection and testing, restore/repair any removed/damaged construction caused by finding and repairing leaks in the air barrier system and restore substrates, insulation and finishes to their original condition.

END OF SECTION

SECTION 07 16 13

POLYMER MODIFIED CEMENT WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes polymer-modified cement waterproofing for positive-side application to concrete.
 - 1. Shotcrete pools and water features.
- B. Related Sections:
 - 1. Division 03 Section "Exhibit Rockwork" for water test requirements.
 - 2. Division 03 Section "Shotcrete."
 - 3. Division 07 Section "Joint Sealants" for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for polymer-modified cement waterproofing.
- B. Samples for Initial Selection: For each type of polymer-modified cement waterproofing indicated.
 - 1. Include Samples of available color selection.
- C. Samples for Verification: For each type of polymer-modified cement waterproofing indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator.
- B. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each type of polymer-modified cement waterproofing.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying polymer-modified cement waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.

- B. Mockups: Provide 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 vertical and horizontal surfaces 9.9 sq. ft. in size.
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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit polymer-modified cement waterproofing to be performed according to manufacturer's written instructions.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.7 WARRANTY

- A. Provide Manufacturer's standard warranty.
- B. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 PREPACKAGED, POLYMER-MODIFIED CEMENT WATERPROOFING

- A. Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with polymer admixture to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists negative-side hydrostatic pressure, has VOC content complying with limits of authorities having jurisdiction, and has properties meeting or exceeding the criteria specified below.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Basis-of-Design Product: AQUAFIN, Inc.; AQUAFIN-2K/m or 1K per manufacturer's recommendations.
 2. Water Permeability: Maximum zero for water at 30 ft when tested according to CE CRD-C 48.
 3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
 4. Flexural Strength: Minimum 710 psi at 28 days when tested according to ASTM C 348.
 5. Bond Strength: Minimum 220 psi at 14 days when tested according to ASTM C 321.
 6. Color: As selected by Architect from full range.
 7. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction, but not exceed 400 g/L.

8. Low-Emitting Materials: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ACCESSORY MATERIALS

- A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

1. Basis-of-Design Product: Aquafin, Inc.; Mortar-LN

- B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

- C. Sealing Tape: Manufacturer's recommended elastomeric product for sealing joints and cracks.

1. Basis-of-Design Product: Aquafin, Inc.; Aquafin Joint Sealing Tape.

- D. Reinforcing Mesh: Polypropylene non-woven fleece, as recommended by waterproofing manufacturer for treating zones subject to cracking.

1. Basis-of-Design Product: Aquafin, Inc.; Aquafin-2K-Fabric.

- E. Sealing Gasket: Elastomeric gasket as recommended by waterproofing manufacturer for sealing PVC pipe and other penetrations.

1. Basis-of-Design Product: Aquafin, Inc.; Aquafin-Gasket 18/18.

- F. Portland Cement: ASTM C 150, Type I.

- G. Slurry-Coat and Protective-Topping Sand: ASTM C 144.

- H. Trowel-Coat Sand: ASTM C 33, fine aggregate.

- I. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and to not create a vapor barrier.

- J. Water: Potable.

2.3 MIXES

- A. Prepackaged, Polymer-Modified Cement Waterproofing: Add prepackaged dry ingredients to mixing liquid according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
- D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - 1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch deep. Fill reveal with patching compound flush with surface.
- E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces according to ASTM D 4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - 2. Clean clay masonry surfaces according to ASTM D 5703.
 - 3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - 1. Saturate surface with water and maintain damp condition until applying waterproofing. Remove standing water.
 - 2. Apply waterproofing to surfaces indicated on Drawings.
 - 3. Number of Coats: Number required for specified water permeability but not less than two.
 - a. Coating Thickness: Maximum application thickness of 47 mils per coat for total thickness of 100 mils.
 - b. Apply first coat as a slurry with brush or roller, and apply subsequent coats with brush, roller, spray, or trowel.
 - c. Vigorously work first coat onto the substrate, forcing the material into surface voids. Apply each subsequent coat into full contact with previous coat.
 - d. Allow manufacturer's recommended time between coats. Dampen surface between coats.

- B. Final Coat Finish: Smooth troweled, at filtration tanks, Brushed, at pools.
 - C. Curing: Air-cure waterproofing for not less than five days immediately after application and prior to being placed in service.
 - D. Curing: Moist-cure waterproofing for not less than three days immediately after application has set, followed by air drying prior to being placed in service unless otherwise recommended in writing by manufacturer.
 - E. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - 1. Onto columns integral with treated walls.
 - 2. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 2 ft. for cast-in-place concrete.
 - 3. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches, where floors, but not walls, are treated.
 - 4. Onto every substrate in areas indicated for treatment.
- 3.4 FIELD QUALITY CONTROL
- A. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.
- 3.5 POOL TEST
- A. Test all indoor and outdoor cast-in-place pools and tanks to the standard specified for shotcrete finished pools per Section 033712.

END OF SECTION 07 16 13

SECTION 07 2100
BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Polyisocyanurate foam-plastic board insulation.
 2. Glass-fiber blanket insulation.
 3. Mineral-wool blanket insulation.
 4. Mineral-wool board insulation.
 5. Spray-applied cellulosic insulation.
 6. Open-cell spray polyurethane foam.
- B. Related Sections:
1. Section 04 2000 "Unit Masonry" for insulation installed in cavity walls.
 2. Section 071326 "Self-Adhering Sheet Waterproofing" for insulated drainage panels installed with plaza deck insulation.
 3. Section 075423 "Thermoplastic-Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 3. Product Data: Laboratory test reports for acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 4. Red List Compliance information: Provide documentation confirming no Red List chemical are present. Documentation to include one of the following:
 - a. Red List Free Declare ID number with VOC disclosure information.
 - b. Complete manufacturer-supplied ingredient list with a letter from the manufacturer confirming there are no Red List materials in proprietary ingredients.
 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:

- a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
- b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 - 2. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Mockups: Install insulation in mockups of assemblies specified in other Sections that are indicated to receive products specified in this Section. Use materials and installation methods specified in this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
- 01 8113 "Sustainable Design Requirements".
 - 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
- Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the most recent Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines as found on EC3 and as listed below for reference:
 - Embodied Carbon (GWP) Baselines:
 - Extruded Polystyrene (XPS) ≤ 25 psi – 8.9 kgCO₂ eq per M²-Rsi.
 - Extruded Polystyrene (XPS) 40psi – 10.9 kgCO₂ eq per M²-Rsi.
 - Extruded Polystyrene (XPS) 60psi – 14.1 kgCO₂ eq per M²-Rsi.
 - Extruded Polystyrene (XPS) 100psi – 20.1 kgCO₂ eq per M²-Rsi.
 - Fiberglass Blanket – 1.06 kgCO₂ eq per M²-Rsi.
 - Mineral Wool Blanket – 2.68 kgCO₂ eq per M²-Rsi.
 - Heavy Density Mineral Wool – 6.82 kgCO₂ eq per M²-Rsi.
 - Cellulose – 0.487 kgCO₂ eq per M²-Rsi.
 - System Boundary: Product Stage A1-A3.
 - Declared Units: 1 square meter with thickness so that R_SI (average thermal resistance) = 1 m²K/W.
 - Product Category Rules:
 - UL Environment PCR for Building Envelope Thermal Insulation, v.2, 2018-04-10.
 - UL Environment PCR for Calculation Rules for the LCA and Requirements on the Project Report, v3.2, 2018-12-11.
 - Institut Bauen und Umwelt e.V. PCR for Mineral insulating materials, v1.1, 2018-12-11.
 - Institut Bauen und Umwelt e.V. PCR for Calculation Rules for the LCA and Requirements on the Project Report, v1.3, 2014-06-19.
 - Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
- General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Adhesives and Sealants:
- Do not use adhesives that contain urea formaldehyde.
 - Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Additional Low-emitting requirements –Insulation within the weatherproofing barrier:
- Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.

- F. Red List Compliance: Insulation products cannot contain any Red List materials or chemical.
- G. Foam Insulation:
 - 1. Foam insulation: Provide fire retardants that contain no hexabromocyclododecane (HBCD) flame retardants. Use Polymeric flame retardants (PolyFR) in lieu of these products.
- H. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas ACFoam and EnergyShield
 - b. Carlisle Coatings & Waterproofing Inc. – Polyiso Board Insulation
 - c. GAF – Energyguard NH HD Plus Polyiso
 - d. Versico – Polyiso Board Insulation
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.3 MINERAL-WOOL BLANKET ACOUSTIC INSULATION

- A. Unfaced, Mineral-Wool Blanket Insulation: 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. Acoustic Performance at 1-1/2inch: NRC 0.85
 - 2. Thickness: as required for STC rating indicated.
- B. Basis of Design: Subject to compliance with requirements, provide one of the following:
 - 1. AFB EVO by Rockwool Inc
 - 2. Owens Corning – Thermafiber SAFB Formaldehyde Free
 - 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.4 MINERAL-WOOL BOARD CAVITY WALL INSULATION

- A. Unfaced, Mineral-Wool Board Insulation: ASTM C 612 Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Fiber Color: Darkened, where indicated.
- B. Basis of Design: Subject to compliance with requirements, provide one of the following:

1. Rockwool Inc Cavityrock.
2. Owens Corning - Thermafiber Rainbarrier
3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

C. Location: continuous insulation at exterior wall construction.

2.5 MINERAL-WOOL BOARD ROOF INSULATION

- A. Rigid, monolithic, dual-density mineral wool insulation board intended for use with mechanically fastened or ballasted roofing membranes to ASTM C726, complete with high density top layer.
- B. Basis of Design: Subject to compliance with requirements, provide Toprock DD by Rockwool Inc. or a comparable product by one of the following:
1. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- C. Low-Slope Roofing Insulation Board: To ASTM C726.
1. Fire performance:
 - a. Rated roof insulation: To FM Approval 4450/4470, Class 1-90.
 - b. Non-combustibility: To ASTM E136.
 - c. External spread of flame on roof surface: To UL 790, Class A.
 - d. Thermal degradation and charring: To UL 263.
 - e. Surface Burning Characteristics: To ASTM E84.
 - 1) Flame spread: 0.
 - 2) Smoke developed: 0.
 2. Water Vapor Transmission: To ASTM E96, 40.8 Perm.
 3. Moisture Resistance: To ASTM C1104, moisture sorption of 0.15 %.
 4. Water absorption less than 1.0 %: To ASTM C209.
 5. Thermal resistance: To ASTM C518,
 - a. R 4.3 hr.ft².F/Btu at 25 °F.
 - b. R 4.2 hr.ft².F/Btu at 40 °F.
 - c. R 3.8 hr.ft².F/Btu at 75 °F.
 - d. R 3.6 hr.ft².F/Btu at 110 °F.
 6. Hail damage resistance: To FM 4470, Class 1-SH.
 7. Impact resistance: To FM 4473, Class 4 and UL 2218, Class 4.
 8. Corrosive resistance: To ASTM C665, Corrosive to steel - Pass.
 9. Stainless steel stress corrosion: To ASTM C871 and ASTM C692.
 10. Compressive strength of entire board: To ASTM C165, at 10 %: 10.88 psi.
 11. Density: To ASTM C303.
 - a. Top layer: 13.7 lb/ft³.
 - b. Bottom layer: 10lb/ft³
- D. Low-Slope Roofing Insulation: Stone wool fiber insulation board.
1. Size: 48 x 48 inches.
 2. Thickness: as indicated on drawings.
- E. Location: at roofing installation.

2.6 MINERAL-WOOL BOARD STUD WALL INSULATION

- A. Unfaced, Mineral-Wool Board Insulation: ASTM C 612 Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Fiber Color: Darkened, where indicated.
- B. Basis of Design: Subject to compliance with requirements, provide one of the following:
 - 1. Comfortbatt by Rockwool Inc
 - 2. Owens Corning - Thermafiber Firespan FF
 - 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- C. Location: insulation at exterior stud wall construction.

2.7 MINERAL-WOOL FLUTE FILLER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following:
 - 1. AFB EVO by Rockwool Inc
 - 2. Owens Corning - Thermafiber Firespan FF
 - 3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Custom cut rigid mineral wool fiber metal deck flute filler.

2.8 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.
 - 1. Thickness: as indicated on drawings.
 - 2. Basis of Design: Subject to compliance with requirements, provide K-13 spray on system by International Cellulose Company or a comparable product by one of the following:
 - a. [GreenFiber](#).
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.9 OPEN-CELL SPRAY POLYURETHANE FOAM

- A. Slow-Rising, Poured-in-Place Spray Polyurethane Foam: Two component, open-cell, spray-applied polyurethane foam using water as a blowing agent.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide products by Demilec USA, or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - 2. Density: 0.5 to 0.6 lb/cu.ft.

3. Thermal Resistance: minimum aged R-value at 1 inch thickness of 3.43 deg F x h x sq. ft./BTU at 75 deg F.
 4. Surface-Burning Characteristics: Comply with ASTM E 84 for Class A or Class 1. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed Index: 450 or less.
- B. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- C. Provide ignition barrier over spray polyurethane foam insulation.
1. Basis of Design: Subject to compliance with requirements, provide FS-1B Ignition Barrier by Flame Seal Products Inc., or a comparable product by one of the following
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.10 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
- C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches between face of insulation and substrate to which anchor is attached.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.11 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Reveal Shield: Water Resistive Air barrier product to cover exposed mineral wool insulation at open rain screen joints:
1. Basis of Design: RevealShield SA Self-Adhered by VaproShield.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 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 at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. 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.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
- B. Mineral Wool Board Insulation: Install insulation as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates, using manufacturer's retaining clips as recommended.
 - 1. Install reveal shield product to cover insulation at all open joints.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
- C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions.
1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
 2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.6 INSTALLATION OF SPRAY POLYURETHANE FOAM

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 2726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Sustainable Design Submittals:
 - 1. **Product Data**: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Data**: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Red List Compliance information: Provide documentation confirming no Red List chemical are present. Documentation to include one of the following:
 - a. Red List Free Declare ID number with VOC disclosure information.

- b. Complete manufacturer-supplied ingredient list with a letter from the manufacturer confirming there are no Red List materials in proprietary ingredients.
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - C. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.
- 1.6 INFORMATIONAL SUBMITTALS
 - A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
 - B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
 - C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
 - D. Field quality-control reports.
- 1.7 QUALITY ASSURANCE
 - A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
 - 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 of typical exterior wall area as shown on Drawings. Panels to include all components necessary for a complete exterior wall assembly.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing
- 1.8 PRECONSTRUCTION TESTING
 - A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups.
 - B. Mockup Testing: Air-barrier assemblies must comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
 - 1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.

2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate in accordance with ASTM E783 or ASTM E2357.
3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate in accordance with ASTM D4541.
4. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.10 FIELD CONDITIONS

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

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement air barrier material for air barrier that does not comply with requirements or that fails to remain airtight within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
 2. Installer's Special Warranty: Form signed by Installer, covering Work of this Section, for warranty period of two years

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- C. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.
- D. Ultimate Elongation: Minimum 350 percent; ASTM D412, Die C.
- E. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested in accordance with ASTM D4541.
- F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- G. UV Resistance: Can be exposed to sunlight for 180 days in accordance with manufacturer's written instructions.

- H. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- I. Red List Compliance: Air Barrier products cannot contain any Red List materials or chemical.
- J. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- K. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- L. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 AIR BARRIERS, VAPOR PERMEABLE

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - 1. Synthetic Polymer Membrane:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Henry Company, Sealants Division. Air-Bloc 17MR.
 - 2) PROSOCO, Inc. Cat 5
 - 3) Tremco incorporated; ExoAir 230
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.3 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Flexible self-adhering sheet flashing composed of modified bituminous sheet laminated to polyethylene sheet. Provide modified bituminous sheet laminated to polyethylene sheet at through-wall metal flashings as shown on the drawings.

- C. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, **0.0250 inch** thick, and Series 300 stainless-steel fasteners.
- E. Provide Self-Adhered transition membrane where indicated, compatible with fluid-applied membrane used.
- 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 one of the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. GE Construction Sealants; Momentive Performance Materials Inc US11000 UltraSpan.
 - c. Pecora Corporation; Sil-Span.
 - d. Tremco Incorporated, an RPM company; Spectrem Simple Seal.
- G. 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 07 9200 "Joint Sealants."
- H. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Strike all concrete masonry unit mortar joints flush.
 - 2. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. 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 transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - 1. Provide compatible butyl based self-adhered membrane sheet flashing between air/water barrier and roofing membrane.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

- D. 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.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
 - 1. At window and door rough openings, mastic must be compatible with silicone window perimeter sealant.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

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

3.6 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- 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. 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, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.
- D. Tests: As determined by Owner's testing agency from among the following tests:
 - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.
 - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783 or ASTM E2357.
 - 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- E. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 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. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

SECTION 07 3213

CLAY ROOF TILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Clay roof tiles.
 - 2. Metal roof flashing
 - 3. Underlayment.
 - 4. Roof insulation.
 - 5. Snow Guards.
- B. Related Requirements:
 - 1. 06 1053 "Miscellaneous Rough Carpentry" for wood nailers.
 - 2. 07 6200 "Sheet Metal Flashing and Trim" for metal roof-penetration flashings counterflashings and flashings not part of this Section.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Samples: For each exposed product and for each color and texture specified.
 - 1. Clay Roof Tiles: Full size, showing full range of values and blends.
 - 2. Accessory Tiles: Full size.
 - 3. Metal Valley Flashing: 12 inches square.
 - 4. Self-Adhering Underlayment: 12 inches square.
 - 5. Fastenings: Wire-tie system components, 12 inches long.
 - 6. Snow Guards: Full size unit.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each type of clay roof tile, based on evaluation of comprehensive tests performed by a qualified testing agency.
- B. Evaluation Reports: From ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. Clay roof tiles, fasteners, and attachment systems.
 - 2. Synthetic underlayment.
 - 3. High-temperature self-adhering underlayment.
- C. Sample Warranty: For manufacturer's materials warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing to include in maintenance manuals.

1.8 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. Clay Roof Tiles: 100 sq. ft. of each type, in unbroken bundles.

1.9 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for clay roof tiles including related roofing materials.
 - a. Size: 48 inches long by 48 inches wide.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.
 - 1. Store on end, on pallets or other raised surfaces. Do not double stack rolls.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- 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, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.12 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.
 - 1. Warranty Period: 50 years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of clay-tile roofing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide clay roof tiles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories, Inc. or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 CLAY ROOF TILES

- A. Existing Clay Tile: Salvage and reuse intact and serviceable existing clay tiles whenever possible. Ensure new clay tiles being incorporated into existing clay tile roofs match existing tiles as closely as possible. Use clay tiles from the same manufacturer as the original, if possible.
- B. Clay Roof Tiles: ASTM C 1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.
 - 1. Basis of Design: Subject to compliance with requirements, provide product by Ludowici Roof Tile or a comparable product by one of the following:
 - a. Boral Roofing; Boral Limited.
 - b. Gladding, McBean; a division of Pacific Coast Building Products, Inc.
 - c. M.C.A. (Maruhachi Ceramics of America, Inc.).
 - d. US Tile.
 - 2. Durability: Grade 2.
 - 3. Profile and Color: match existing.
 - 4. Size: as indicated.
 - 5. Finish and Texture: Matte, smooth.

2.3 UNDERLAYMENT MATERIALS

- A. Felt Underlayment: ASTM D 226/D 226M, Type II, asphalt-saturated organic felt, unperforated.
- B. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 40-mil-thick; with slip-resisting, polymer-film-reinforced or glass-reinforced top surface laminated to layer of butyl or SBS-modified-asphalt adhesive; with release backing; cold applied; and evaluated and documented to be suitable for use for intended purpose under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 - 1. Basis of Design: Subject to compliance with requirements, provide Blueskin Roof PE 200HT or a comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. GAF.
 - c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
 - d. Owens Corning.
 - 2. Thermal Stability: Stable after testing at 240 deg F according to ASTM D 1970/D 1970M.
 - 3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F according to ASTM D 1970/D 1970M.

2.4 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. Firestone Building Products.
 - d. Hunter Panels.
 - e. Rmax, Inc.

2.5 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Cornell Corporation.
 - c. Dow Chemical Company (The).
 - d. Johns Manville; Berkshire Hathaway Inc.
 - e. Rmax, Inc.
 - 2. Polyisocyanurate-Foam Thickness: 2 inches.
 - 3. Oriented-Strand-Board Nominal Thickness: 5/8 inch.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
- D. Wood Nailer Strips: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."
- E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

2.7 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586/D 4586M, Type II, asbestos free.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone-based joint sealant of type, grade, class, and use classifications required to seal joints in clay-tile roofing and remain watertight.
- C. Roofing Asphalt: ASTM D 312, Type IV.
- D. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
- E. Mortar: ASTM C 270, Type M, with ASTM C 979/C 979M, pigmented mortar matching the color of clay roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar.
- F. Eave Closure: Manufacturer's standard eave closure formed to shape of clay roof tile.
- G. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 06 1053 "Miscellaneous Rough Carpentry."

2.8 FASTENERS

- A. Roofing Nails: ASTM F 1667, copper, 0.135-inch-diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch-diameter head; of sufficient length to penetrate 3/4 inch into substrate or through thickness of the sheathing, whichever is less.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- B. Underlayment Nails: stainless-steel, or hot-dip galvanized-steel wire with low-profile metal or plastic caps, 1-inch minimum diameter.
 - 1. Provide with minimum 0.0134-inch-thick cap, and with minimum 0.105-inch-thick shank of length to penetrate at least 3/4 inch into roof sheathing.
- C. Corrosion resistant meeting ASTM A641 Class 1 or approved corrosion resistance, of No. 11 gauge diameter and of sufficient length to properly penetrate 3/4" into or through the thickness of the deck, whichever is less. The head of the nail used for tile fastening shall not be less than 5/16" (.3125") and complying with ASTM F 1667 for dimensional tolerances (+0%, -10%).

- D. Single-Line, Wire-Tie System: Interconnecting eave-to-ridge system, minimum 0.101-inch-diameter copper wire, preformed to accommodate clay roof tile type and application indicated.
- E. Wire Ties: copper, 0.083-inch minimum diameter.
- F. Storm Clips: Brass, minimum 0.048-by-1/2-inch strap-type, L-shaped retainer clips designed to secure side edges of clay roof tiles. Provide with two fastener holes in base flange.

2.9 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Copper.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item.
 - 1. Apron Flashings: Fabricate with lower flange extending a minimum of 6 inches over and 4 inches beyond each side of downslope tile roofing and 6 inches up the vertical surface.
 - 2. Step Flashings: Fabricate with a head lap of 3 inches and a minimum extension of 5 inches both horizontally and vertically.
 - 3. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches beneath the tile roofing, with a 1-inch-high vertical return to form a runoff channel.
 - 4. Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch-high, inverted-V-profile water diverter at center of valley and equal flange widths of 12 inches, use ribbed flashing product.
 - 5. Drip Edges: Fabricate in lengths not exceeding 10 feet, with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches from pipe onto roof.

2.10 PAD-TYPE SNOW GUARDS

- A. Flat-Mounted Metal Snow Guard Pads:
 - 1. Basis of Design: Subject to compliance with requirements, provide PD10 Half Round Pad-Style Snow Guard by Alpine Snow Guards, or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - 2. Material: Copper sheet.
 - 3. Finish: Mill.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.
- B. 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 TILE REMOVAL (REROOF APPLICATIONS)

- A. Where work involves partial replacement or repair of roof, verify each tile for tightness and continued use. Mark tiles which have been identified for replacement or re-installation for approval within 30 days of Notice to Proceed. Mark tiles identified for removal with a non-destructive color mark which can be easily removed. Re-fasten tiles fastened with non-copper fasteners with proper copper fasteners.

3.3 UNDERLAYMENT INSTALLATION

- A. General: Comply with clay roof tile manufacturer's written instructions and with recommendations in NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are indicated.
 1. Cover ridge and hip wood nailers with underlayment strips.
- B. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
 1. Extend self-adhering sheet underlayment over entire roof deck.
 2. Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches beyond penetrating elements and return vertically against penetrating elements not less than 4 inches.
 3. At low slope roofs with slopes below 3:12, two layers are required.
 4. Install in accordance with the manufacturer's instructions.

3.4 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."
 1. Install metal flashings according to clay roof tile manufacturer's written instructions and recommendations in NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
- C. Step Flashings: Install with a head lap of 3 inches and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
- D. Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.

- E. Rake Pan Flashings: Install over underlayment and fasten to roof deck.
- F. Rake Drip Edges: Install over underlayment and fasten to roof deck.
- G. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
- H. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

3.5 WOOD NAILERS

- A. Install wood nailers at ridges and hips and securely fasten to roof deck

3.6 CLAY ROOF TILE INSTALLATION

- A. General: Install clay roof tiles according to manufacturer's written instructions and recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions" and NRCA's "NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are indicated.
 - 1. Intermingle existing reusable clay tiles removed from the repair area with new clay tiles to provide a smooth visual transition between new and existing areas.
 - 2. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
 - 3. Extend tiles 2 inches over eave fasciae.
 - 4. Nail Fastening: For adequate uplift securement of the clay roof tiles, utilize one (11 gage. 0.135 in. diameter) ASTM F1667 copper nails per tile of sufficient length.
 - a. Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
 - b. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck and fasten to nails driven into deck.
 - 5. Wire-Tie Fastening: Install wire-tie systems and fasten clay roof tiles according to manufacturer's written instructions.
 - 6. Mortar Setting: Install clay roof tile according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."
 - 7. Storm Clips: Install to capture edges of longitudinal sides of clay roof tiles and securely fasten to roof deck.
 - 8. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
 - 9. Install clay roof tiles with color blend approved by Architect.
- B. High-Profile Clay Roof Tile Installation:
 - 1. Install tile eave closure.
 - 2. Provide minimum 3-inch lap between succeeding courses of clay roof tiles.
 - 3. Install rake tiles indicated.
 - 4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement.
- C. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley from highest to lowest point.
 - 1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
 - 2. Do not nail tiles to metal flashings.

3.7 SNOW GUARD INSTALLATION

- A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.
 - 1. Flat-Mounted, Snow Guard Pads: Hook and mechanically anchored through predrilled holes concealed by roof tiles.

3.8 REPAIR AND REPLACEMENT

- A. Damaged Roof Tiles:
 - 1. Break out damaged materials.
 - 2. Drive fastener flush.
 - 3. Apply minimum 3/8 inch by 2-inch bead of approved adhesive in course below replacement tiles.
 - 4. Immediately set replacement tile in position assuring proper contact.

3.9 ADJUSTING AND CLEANING

- A. Remove and replace damaged or broken clay roof tiles.
- B. Remove excess clay roof tiles and debris from Project site.

END OF SECTION

SECTION 07 4113

FORMED METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes metal roof panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of deck purlins and rafters during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panels to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. 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 for typical roof area only, the roof edge conditions, complete with all sheet metal components.
 - a. Size: 12 feet long by 6 feet.
 - b. Each type of exposed seam and seam termination.
 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

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

1.9 FIELD CONDITIONS

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

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 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.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section.
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".

- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Low-emitting requirements – Adhesives and Sealants located inside the weatherproof barrier:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.
- D. Structural Performance: Provide metal panel 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.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- E. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- F. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 15 lbf/sq. ft.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- H. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- I. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- J. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and panel striations between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; Double-Lock Zee-Lock (180o Seam) or comparable product by one of the following: No substitutions request will be accepted.

2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.024 inch
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Painted materials shall have a removable plastic film to protect the paint during roll forming, shipping and handling.
 - d. Color: As selected by Architect from manufacturer's full range.
3. Clips: Continuous Zee-Rib to accommodate thermal movement.
 - a. Material: 0.024-inch nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Joint Type: Double folded.
5. Panel Coverage: 16 inches.
6. Panel Height: 2.0 inches.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: Stable after testing at 220 deg F; ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grace Ice and Watershield HT - Grace, W.R. & Co.
 - b. Grace Ice and Watershield Grace, W.R. & Co.
 - c. Grace Ultra Grace, W.R. & Co.
 - d. Soprema Lastobond Shield HT
 - e. Polyglass Polystick MTS Plus

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish, and comply with warranty requirements.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using factory set, non-adjustable, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 3. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Color: To be selected from 1. almond. 2. parchment 3. Cityscape samples.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 1. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 6200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
 3. Locate and space fastenings in uniform vertical and horizontal alignment.
 4. Install flashing and trim as metal panel work proceeds.
 5. Panels should be continuous without end laps.
 6. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so metal roof panels, and factory-applied sealant are completely engaged.
 - 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal panel installation, including accessories. Report results in writing.

- B. Remove and replace applications 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.
- E. Installer must have installation shop drawings on site at all times.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 5423

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Adhered thermoplastic polyolefin (TPO) roofing system.
 - 2. Roof insulation.
 - 3. Cover board.
 - 4. Walkways.
- B. Related Requirements:
 - 1. Division 6 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and wood-based, structural-use roof deck panels.
 - 2. Section 06 1600 "Sheathing" for wood-based, structural-use roof deck panels.
 - 3. Section 07 2100 "Thermal Insulation" for roof insulation.
 - 4. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 5. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
 - 6. Section 22 1423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.
- B. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 2. Product Data: For adhesives located inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
 2. Base flashings and membrane termination details.
 3. Flashing details at penetrations.
 4. Tapered insulation, including slopes, coordinated with primary and secondary drain locations.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with adjoining air barrier.

- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.
- E. Samples for Verification: For the following products:
 - 1. Roof membrane of color required.
 - 2. Walkway pads or rolls, of color required.

1.6 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
- B. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
- C. Qualification Data: For firms and persons specified in the "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.
- D. Product Test Reports: For roof membrane and insulation and assembly, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- E. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- F. Warranty: Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
- G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 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.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion, No Dollar Limit
- C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and 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. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Accelerated Weathering and UV resistance: Roof membrane shall be tested according to ASTM D 573 at 275 degrees F.
 - 3. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Roofing System Design: Tested by a qualified testing agency to resist the uplift pressures indicated on drawings.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.
- H. Low-emitting requirements – Adhesives and Sealants located inside the weatherproof barrier:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- I. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carlisle SynTec Incorporated.
 - 2. GAF Materials Corporation.
 - 3. Holcim Elevate.
 - 4. Johns Manville.
- B. Source Limitations: Manufacturer must adhere to ISO 9000 compliance standards. Obtain all major roofing components including but not limited to membranes, adhesives, and roofing edge metal from a single manufacturer.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D 6878/D 6878M, internally fabric- or scrim-reinforced, fabric backed, TPO sheet.
 - 1. Thickness: 60 mils, nominal.
 - 2. Exposed Face Color: As selected by Architect from manufacturer's full range, having specified solar reflective index

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Bonding Adhesive: Manufacturer's standard, water based.
- E. Slip Sheet: Manufacturer's standard, of thickness required for application.
- F. Splice Adhesive and Cleaner: Single-component butyl splicing adhesive and solvent-based splice cleaner.
- G. Splice Primer and Tape: Manufacturer's standard synthetic rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.
- H. Lap Sealant: Manufacturer's standard single-component sealant.
- I. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- J. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- K. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
 - 1. Fasteners: 1-1/2-inch stainless steel fasteners with neoprene washers.
- L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- M. 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.
- N. Conductive primer for Electronic Leak Detection.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Compressive Strength: 20 psi.
 - 2. Size: 48 by 96 inches.
 - 3. Thickness: 5 inches, R-25
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.

2. Minimum Thickness: 1/4 inch.
3. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M fiber-reinforced gypsum board.
 1. Thickness: 1/2 inch.
 2. Surface Finish: Unprimed.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 4. Provide cover board compliant with EPD requirements in Section 06 1600 "Sheathing".
- E. Substrate Joint Tape: 6- or 8-inch-wide, coated, glass fiber.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 1. Size: Approximately 36 by 60 inches.
 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.

4. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3100 "Steel Decking."

- 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 system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 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 end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 2726 "Fluid-Applied Membrane Air Barriers."

3.4 VAPOR RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
- D. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- H. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.

3.7 ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, 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 roof membrane and sheet flashings.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to 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 splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
1. Set walkway pads in cold-applied adhesive.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
1. Low-Voltage ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using low-voltage horizontal membrane scanning platform or vertical membrane scanning in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed wall sheet metal fabrications.
 - 5. Formed equipment support flashing.
 - 6. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 04 2000 "Unit Masonry" for installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
 - 3. Section 04 4200 "Exterior Stone Cladding" for installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
 - 4. Section 07 4213 "Formed Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
 - 5. Section 07 5423 "Thermoplastic Polyolefin (TPO) Roofing" for installation of sheet metal flashing and trim integral with roofing.
 - 6. Section 07 5556 "Fluid-Applied Protected Membrane Roofing" for installation of sheet metal flashing and trim integral with roofing.
 - 7. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 8. Section 07 9500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 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.

1.4 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.

1.5 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 manufactured product and accessory.
- B. Sustainable Design Submittals:
 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: For sheet metal flashing and trim.
 1. Include plans, elevations, sections, and attachment details.
 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and 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 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- E. Samples for Verification: For each type of exposed finish.
 1. Sheet Metal Flashing: 12 inches 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 long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 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.
- B. Mockups: Install sheet metal flashing and trim in mockups of assemblies specified in other Sections that are indicated to receive products specified in this Section. Use materials and installation methods specified in this Section.
 - 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.

1.9 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.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: 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. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- 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: 120 deg F, ambient; 180 deg F, material surfaces.
- F. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- G. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying stripable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: match metal roof.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Basis of Design: Subject to compliance with requirements, provide [Henry Company](#); Blueskin PE200 HT, or a comparable product by one of the following:
 - a. [Carlisle Residential, a division of Carlisle Construction Materials](#); WIP 300HT.
 - b. [Grace Construction Products, a unit of W. R. Grace & Co.-Conn.](#) Ultra
 - c. [Metal-Fab Manufacturing, LLC](#); MetShield.
 - d. [Owens Corning](#); WeatherLock Specialty Tile & Metal Underlayment.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 ALUMINUM BRAKE-METAL AND TRIM WORK

- A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the work as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with the Work of this Section.
 - 1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable. Provide sharp bends in formed work without tearing, cracking, or grain separation of base metal.
 - 2. Provide sheet metal panning not less than 0.05 inch thick. Reinforce panning as required to prevent oil canning.
 - 3. Fasten trim clips, at not more than 16 inches on center.
- B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent "oil canning" or deformation of the finished work. Material deemed defective by the architect will be replaced at no cost to the Owner.
- C. Brake Metal to include products indicated on drawings.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item 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 or manufactured item.
 - 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. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: Aluminum High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.6 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Basis of Design: Subject to compliance with requirements, provide [products by Hohmann & Barnard, Inc.](#) or a comparable product by one of the following:
 - a. [Fry Reglet Corporation.](#)
 - b. [Heckmann Building Products, Inc.](#)
 - c. [Hickman Company, W. P.](#)
 - d. [Keystone Flashing Company, Inc.](#)
 - e. [National Sheet Metal Systems, Inc.](#)
 - 2. Material: Stainless steel, 0.019 inch thick.
 - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 - 6. Accessories:

- a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
7. Finish: Mill.

2.7 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. 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.
 3. Obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- F. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and Do not use graphite pencils to mark metal surfaces.
- G. Do not use graphite pencils to mark metal surfaces.

2.8 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Built-in Gutters:
1. Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
 2. Fabricate in minimum 96-inch-long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
 3. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
 4. Fabricate from the following materials:
 - a. Stainless Steel: 0.0156 inch thick.
 - b. Finish to match metal roofing.
- B. Hanging Gutters:
1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
 2. Fabricate in minimum 96-inch-long sections.
 3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
 4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
 5. Gutter Profile: as indicated on drawings and in accordance with cited sheet metal standard.
 6. Expansion Joints: Butt type with cover plate.
 7. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
- C. Downspouts: Fabricate round downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Hanger Style: as indicated on drawings.
 2. Fabricate from the following materials:
 - a. Aluminum: 0.024 inch thick.
- D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

2.9 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch-wide, exposed cover plate.
 2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support

edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
2. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.

- C. Roof and Roof-to-Wall Transition Roof-to-Roof Edge-Flashing (Gravel-Stop) Transition Roof-to-Roof Edge-Flashing (Gravel-Stop) and Fascia-Cap Transition Expansion-Joint Cover: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

- D. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

- E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

- F. Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

- G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

- H. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

2.10 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

- C. Opening Flashings adjacent to curtain wall and storefront: Fabricate flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

- D. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

2.11 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 2 inches.
- B. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- C. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lapp joints not less than 4 inches.

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, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

3. 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.
 4. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 5. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 6. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 7. Torch cutting of sheet metal flashing and trim is not permitted.
 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
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 sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, 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.
 2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."
- G. 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; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum 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.

- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
1. Join sections with riveted and soldered joints or joints sealed with sealant.
 2. Provide for thermal expansion.
 3. Attach gutters at eave or fascia to firmly anchor them in position.
 4. Provide end closures and seal watertight with sealant.
 5. Slope to downspouts.
 6. Fasten gutter spacers to front and back of gutter.
 7. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 8. Anchor gutter with spikes and ferrules spaced not more than 30 inches apart.
 9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.
- C. Built-in Gutters:
1. Join sections with riveted and soldered joints.
 2. Provide for thermal expansion.
 3. Slope to downspouts.
 4. Provide end closures and seal watertight with sealant.
 5. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
 - a. Lap sides minimum of 2 inches over underlying course.
 - b. Lap ends minimum of 4 inches.
 - c. Stagger end laps between succeeding courses at least 72 inches.
 - d. Fasten with roofing nails.
 - e. Install slip sheet over underlayment.
 6. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 18 inches apart.
 7. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.
- D. Downspouts:
1. Join sections with 1-1/2-inch telescoping joints.
 2. Provide hangers with fasteners designed to hold downspouts securely to walls.
 3. Locate hangers at top and bottom and at approximately 60 inches o.c.
 4. Provide elbows at base of downspout to direct water away from building.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:

1. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings:
 1. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.
 4. Secure in waterproof manner by means of anchor and washer at 36-inch centers unless otherwise indicated.
- F. 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.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 2000 "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Section 03 3000 "Cast-in-Place Concrete."
- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 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.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 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.

3.10 PROTECTION

- A. 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 sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 7200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Pipe and duct supports.
 - 3. Pipe portals.
 - 4. Preformed flashing sleeves.
- B. Related Sections:
 - 1. Section 05 5000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 07 6200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 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.

1.4 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. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

- D. Delegated-Design Submittal: For roof curbs 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 mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
 - 2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 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. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 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.

1.8 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer 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 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design roof curbs, to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: As indicated on Drawings.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings The Pate Company or comparable product by one of the following:
 - a. AES Industries, Inc.
 - b. Bristolite Daylighting Systems, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. KCC International Inc.
 - e. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - f. Metallic Products Corp.
 - g. Milcor; Commercial Products Group of Hart & Cooley, Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
 - 1. Finish: Baked enamel or powder coat.
 - 2. Color: As Selected from manufacturer's full range.
- E. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.

2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
6. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
8. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
12. Security Grille: Provide where indicated.

2.3 PIPE AND DUCT SUPPORTS

- A. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; accommodating up to 7-inch-diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.
- B. Curb-Mounted Pipe Supports: Galvanized steel support with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-bearing pipe support accommodating up to 20-inch-diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
- C. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
 1. Finish: Manufacturer's standard.

2.4 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless steel snaplock swivel clamps.

2.5 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products.
 - b. Menzies Metal Products.
 - c. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - 3. Diameter: As indicated on Drawings.
 - 4. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products.
 - b. Menzies Metal Products.
 - c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - d. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - 3. Height: 13 inches.
 - 4. Diameter: As indicated on Drawings.
 - 5. Finish: Manufacturer's standard.

2.6 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
 - 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
 - 2. 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.
- B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- C. Steel Tube: ASTM A 500, round tube.
- D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- E. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.7 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. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Underlayment:
 - 1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 - 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils 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.
 - 5. 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:
 - 6. 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.
- F. 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:
 - 1. 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.
- G. 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.
- H. 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.
- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 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.

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, excessive oil canning, 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. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 2. 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. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- E. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- F. Security Grilles: Weld bar intersections and, using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.
- G. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Clean exposed surfaces according to manufacturer's written instructions.
- C. Clean off excess sealants.
- D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Related Requirements:
 - 1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 REFERENCES

- A. The following publications govern the work of this Section and are hereby incorporated in the Contract Documents as if bound herein. The standards described apply generally unless specifically indicated otherwise in the text. They are identified below by their publishers and are referred to in the text by basic designation only.
 - 1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
 - ASTM E 84B91a Surface Burning Characteristics of Building Materials
 - ASTM E 814B88 Fire Tests of Through-Penetration Fire Stops
 - ASTM C 1193B91 Guide for Use of Joint Sealants
 - 2. UNDERWRITERS LABORATORIES (UL)
 - UL-05B92 Fire Resistance Directory
 - UL 723B93 Test for Surface Burning Characteristics of Building Materials
 - UL 1479B83 Fire Tests of Through-Penetration Firestops
 - UL 2079 Tests for Fire Resistance of Building Joint Systems

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, 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.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. 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.
- H. 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. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system 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.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. 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.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming 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.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 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 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 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 system 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 systems are 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 material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 8443
JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. 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 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
 2. Section 07 9500 "Expansion Control" for fire-resistive architectural joint systems.
 3. Section 09 2216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.8 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.

1.9 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 1. Environmental Product Declarations:
 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – General: For Paints and Coatings, Adhesives and Sealants, Flooring products, Ceiling finishes, Wall finishes, any insulation products internal to the weatherproofing envelope
 1. General Emissions Evaluation: Paints and Coatings must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping 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.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. Specified Technologies, Inc.

- c. [Tremco, Inc.; Tremco Fire Protection Systems Group.](#)
 - d. [USG Corporation.](#)
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - 2. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 - a. [Grace Construction Products.](#)
 - b. [Hilti, Inc.](#)
 - c. [Johns Manville.](#)
 - d. [3M Fire Protection Products.](#)
 - e. [Tremco, Inc.; Tremco Fire Protection Systems Group.](#)
 - f. [USG Corporation.](#)
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
 - 2. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 - a. [Grace Construction Products.](#)
 - b. [Hilti, Inc.](#)
 - c. [Johns Manville.](#)
 - d. [3M Fire Protection Products.](#)
 - e. [Tremco, Inc.; Tremco Fire Protection Systems Group.](#)
 - f. [USG Corporation.](#)
- 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 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 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.

3.6 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.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Preformed joint sealants.
 - 5. Acoustical joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. 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.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 1. Joint-sealant location and designation.
 2. Manufacturer and product name.
 3. Type of substrate material.
 4. Proposed test.
 5. Number of samples required.
- D. Preconstruction Laboratory 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 are needed for adhesion.
- E. 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.
- F. Field-Adhesion-Test Reports: For each sealant application tested.
- G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. 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.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, 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 kind of sealant and joint substrate.
 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.
 5. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - 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.
 6. 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.
 7. 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.

1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are 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.

1.9 WARRANTY

- A. Special Installer's Warranty: 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 agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 20 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 stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from 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 JOINT SEALANTS, 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. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
 - 1. Sealant materials exposed to view shall match colors of adjacent surfaces.
 - a. Provide custom colors to match Architect's samples.
 - 2. Provide custom-blended colors as needed for color matching as follows:
 - a. Sealant Joints in Masonry: Match mortar color
 - b. Joints in Cast Stone: Match color of matrix
 - c. Joints Around Doors, Windows, and Openings: Match color of adjacent wall material
 - d. Joints in Tile: Match grout color
 - e. Joints in Floors: Match control sample provided by Architect

3. Fully concealed joints:
 - a. As selected by Architect from manufacturer's full color range which has best overall performance characteristics required for application

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; 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. Pecora Corporation; 301 NS, 311 NS, 890, or 890FTS.
 - c. Sika Corporation, Construction Products Division; SikaSil WS-290.
 - d. Tremco Incorporated; Spectrem 1 or Spectrem 800.
- B. Silicone, S, NS, 50 NT: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; 864, 895 or 898.
 - c. Sika Corporation, Construction Products Division; SikaSil WS-295.
 - d. Tremco Incorporated; Spectrem 2 or Spectrem 3.

2.3 SELF-LEVELING SILICONE TRAFFICJOINTS

- A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL; ASTM C 920, Type SL, Class 100/50, Use T; jet fuel resistant; gun-grade.
 - a. Tremco Incorporated; Spectrem 900SL.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS; ASTM C 920, Type S, Grade NS, Class 100/50, Use T; gun-grade.
 - a. Tremco Incorporated; Spectrem 800.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. STPE, Mildew Resistant, S, NS, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 150.
 - b. Pecora Corporation; 898 NST.
 - c. Tremco Incorporated; Tremsil 200.

2.5 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
 - a. Pecora Corporation; Dynatrol II

- B. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation, Construction Products Division; Sikaflex 2c NS EZ Mix.
 - d. Tremco Incorporated; Vulkem 227.
- C. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; MasterSeal NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation, Construction Products Division; Sikaflex 2c NS EZ Mix.

2.6 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20+.
 - b. Pecora Corporation; AC-20 FTR
 - c. Pecora Corporation; AIS 919
 - d. Tremco Incorporated; Tremflex 834.

2.7 PREFORMED JOINT SEALANTS

- A. Preformed Silicone Joint Sealants: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Pecora Corporation; Sil-Span.
 - c. Tremco Incorporated; Spectrem Simple Seal.
 2. Joint Seal Width: Joint size indicated on Drawings plus 0.75 inch.
 3. Joint Seal Color: As selected by Architect from full range of industry colors.
- B. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 - b. MM Systems Corporation; EIF EIS SIF.
 - c. Tremco Incorporated; ExoAir Eco
 - d. Tremco Incorporated; ExoAir Trio
 - e. Tremco Incorporated; Illmod 600
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Movement Capability: -25 percent/+25 percent.
 3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
- B. 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. Pecora Corporation; AIS-919.
 - c. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Hilti CP605
 - c. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - d. Pecora Corporation; AIS-919.
 - e. Tremco, Inc.; Tremco Acoustical Sealant.
 - 3. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.
- C. Sheet caulking for junction boxes:
 - 1. "Lowry's Electrical Box Sealer".
 - 2. Tremco sheet caulking.
- D. Sheet caulking for junction boxes at fire-rated assemblies:
 - 1. "Firestop Putty Pads" by Hevi-duty/Nelson.
 - 2. Specified Technologies, Inc.
 - 3. HILTI CP-617.
- E. Backing Rod: Closed-cell, neoprene rod or polyethylene foam.
- F. Cementitious sealant:
 - 1. Spray-applied (40 pcf) Monokote Z-146
- G. Sprayed Acoustical Sealant:
 - 1. STI "SpecSeal Smoke 'N' Sound Acoustical Spray"
 - 2. Hilti CP672.

2.9 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 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 performance of the Work.
- 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.
 - 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.
 - 4. Install all sealants free of contaminated substances, in a uniform, continuous smooth free application without air gaps or voids, regardless of abutting surface profiles. A high level of workmanship and finish is required, as determined by the Architect.
- 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.
 - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- 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 3/8 inch. Hold edge of sealant bead 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.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 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 of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to 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 complies with 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 material, 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.

3.6 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.

3.7 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.8 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior and interior joints in horizontal traffic surfaces.
 - 1. Joint Sealant:
 - a. Silicone NS 100/50 T
 - b. Urethane M NS 50 T.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant:
 - a. Silicone S NS 100/50 NT.
 - b. Silicone, S, NS, 50 NT
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints at the interior of window perimeters.
 - 1. Joint Sealant:
 - a. Silicone S NS 100/50 NT.
 - b. Silicone, S, NS, 50 NT
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant: Latex OP NF.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant: STPE, Mildew Resistant, S, NS, NT.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant: Acoustical.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 07 92 01
JOINT SEALANTS – ANIMAL EXHIBITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealing and caulking joints in animal accessible areas where shown on the Drawings and elsewhere as required, to provide a positive barrier against passage of moisture and passage of air.
2. Preparing sealant substrate surfaces that will come in contact with all sealant/caulking as per the specific instructions of the manufacturer.
3. Provide all the sealant, backing, and other required materials, whether specified or not, needed for a complete installation.

B. Related Sections:

1. See structural drawings general notes in conjunction with cast in place and precast concrete.
2. Division 07 Section "Joint Sealants" for sealants used outside of animal accessible areas.
3. Division 08 Section "Hollow Metal Doors and Frames" for additional sealants used in conjunction with door frames.
4. Division 08 Section "Specialty Glass and Glazing" for joint sealants used in conjunction with exhibit glazing.

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 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. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.
 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. 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.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in ½ inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. 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.
- 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. 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 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: Five 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 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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method of Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. 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.
- D. 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.
- E. 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.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SEALANTS

- A. Provide the following sealants, where scheduled (See Schedule 3.7) or otherwise required for a complete and proper installation:
 - 1. TYPE 'A' - NOT USED
 - 2. TYPE 'B' - Epoxy Sealant (Prison Caulk):
 - a. Acceptable Products or equal in quality:

- 1) 'Pecora' Dynapoxy EP-1200.
 - 2) Dynaflex or DynaflexSC in place of options 1-3 at glazing conditions exposed to animals and at mural walls
 - b. Provide a dual sealant bead with first recessed bead with Tremco Dymonic FC (One-part urethane) with second bead of Epoxy Sealant.
 3. TYPE 'C' - NOT USED
 4. TYPE 'D' - NOT USED
 5. TYPE 'E' - NOT USED
 6. TYPE 'F' One-Part Low Modulus Silicone Sealant:
 - a. Basis of design for quality:
 - 1) 'Dow Corning' 795.
 7. TYPE 'G' NOT USED
 8. Type "H" NOT USED
- B. Colors:
1. Provide custom colors where required by individual Specification Sections or as indicated on the Drawings.
 2. Where custom colors are not required, colors will be selected by the Architect from manufacturer's standard color range.
 - a. Should any selected standard color not be available from a substitute manufacturer, provide such colors at no additional cost to the Owner.
 3. In concealed installations, use standard grey or black sealant.

2.3 PREFORMED JOINT SEALANTS

- A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
1. Products: Subject to compliance with requirements, provide quality equal to one of the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. GE Advanced Materials - Silicones; UltraSpan US1100.
 - c. May National Associates, Inc.; Bondaflex Silbridge 300.
 - d. Pecora Corporation; Sil-Span.
 - e. Sealex, Inc.; ImmerSeal.

- B. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
 - 1. Products: Subject to compliance with requirements, provide quality equal to one of the following:
 - a. Dayton Superior Specialty Chemicals; Polytite Standard.
 - b. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 - c. Sandell Manufacturing Co., Inc.; Polyseal.
 - d. Schul International, Inc.; Sealtite or Sealtite 50N.
 - e. Willseal USA, LLC; Willseal 150 or Willseal 250.

2.4 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) as approved by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 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 but not limited to:
 - a. Concrete.
 - b. Wood
 - c. Cement Plaster Finish.
 - 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 but not limited to:
 - a. Metal.
 - b. Glass.
- 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.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- 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 3/8 inch. Hold edge of sealant bead 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.

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 of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 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
- B. 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 SCHEDULE

Sealant Type	Location
Type 'A'	-NOT USED
Type 'B'	-General Sealant for use within Exterior Animal Areas**, including, but not limited to, the following: -All Animal Holding Rooms Interior application
Type 'D'	- NOT USED
Type 'E'	- NOT USED
Type 'F'	-Aluminum to Concrete/Masonry -Exhibit Viewing Glass (unless noted otherwise on drawing detail) -Exterior – glass to metal. -Other Glazing Joints
Type 'G'	- NOT USED

** Animal areas are defined as spaces, rooms, or exhibits that animals have direct access to.

END OF SECTION 07 92 00

SECTION 07 9500
EXPANSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior expansion control systems.
 - 2. Exterior wall expansion control systems.
 - 3. Roof expansion control systems.
- B. Related Requirements:
 - 1. Section 07 9200 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.3 ACTION SUBMITTALS

- A. Product Data: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Data:** For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- C. Shop Drawings: For each expansion control system specified.
 - 1. Include plans, elevations, sections, details, splices, blackout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system.
 - 2. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- D. Samples for Initial Selection: For each type of expansion control system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- E. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of typical expansion joint cover assembly 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.
- B. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Construction Specialties or a comparable product by one of the following:
 - 1. Balco, Inc.
 - 2. JointMaster/InPro Corporation.
 - 3. MM Systems Corporation.
 - 4. Nystrom, Inc.
 - 5. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.
- B. Expansion Joint Design Criteria:
 - 1. Type of Movement: Thermal.
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section.
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.4 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Floor-to-Floor:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Load Capacity:
 - 1) Uniform Load: 150 lb/sq. ft..
 - 2) Concentrated Load: 2000 lb.
 - 3) Maximum Deflection: 0.5 inch.
 - e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Elastomeric seal, recessed.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.

- B. Metal-Plate Floor Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Basis of Design Product: Construction Specialties PC 200
 2. Application: Floor to floor.
 3. Installation: Surface mounted.
 4. Load Capacity:
 - a. Uniform Load: 50 lb/sq. ft..
 - b. Concentrated Load: 300 lb.
 - c. Maximum Deflection: 0.0625 inch.
 5. Cover-Plate Design: Plain.
 6. Exposed Metal:
 - a. Aluminum: Clear anodic, Class II.
- C. Metal-Plate Floor Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Basis of Design Product: Construction Specialties PC 200
 2. Application: Floor to floor.
 3. Installation: Surface mounted.
 4. Load Capacity:
 - a. Uniform Load: 50 lb/sq. ft..
 - b. Concentrated Load: 300 lb.
 - c. Maximum Deflection: 0.0625 inch.
 5. Cover-Plate Design: Plain.
 6. Exposed Metal:
 - a. Aluminum: Clear anodic, Class II.
- D. Floor-to-Floor:
1. Basis of Design Product: Construction Specialties ALR
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Load Capacity:
 - 1) Uniform Load: 150 lb/sq. ft..
 - 2) Concentrated Load: 2000 lb.
 - 3) Maximum Deflection: 0.5 inch.
 - e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 3. Type: recessed metal cover.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
- E. Floor-to-Wall:
1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 2. Type: Elastomeric seal, recessed.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.

- c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- F. Wall-to-Wall:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Elastomeric seal, recessed.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- G. Wall Corner:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Elastomeric seal, recessed.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- H. Wall-to-Ceiling:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Elastomeric seal, recessed.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- I. Ceiling-to-Ceiling:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Elastomeric seal.

- a. Metal: Aluminum.
 - 1) Finish: Mill.
 - b. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- J. Acoustic Joint
- 1. Basis of Design: QuietJoint by Emseal Joint Systems LTD.
 - a. Silicone external color facing to be factory-applied to the foam. Silicone coating to be available in a range of not less than 26 standard colors for coordination with typical building materials.

2.5 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Preformed Silicone Expansion Joints
- 1. Basis of Design Product: Seismic Colorseal by Emseal.
 - 2. Type: Provide watertight flexible, preformed silicone rubber expansion systems that meet the specified movement requirements for applications indicated
 - a. Seal Material:
 - 1) High performance engineered silicone seal that is a minimum of 0.50 inch thick and is factory cured and fused to a cellular polyester/polyurethane foam backer block creating a monolithic and binary sealing system. A field applied primer-less one-part silicone sealant is used to achieve a 3-sided bond to the expansion joint sidewalls on each side of the preformed silicone seal.

2.6 ROOF EXPANSION JOINTS

- A. Provide watertight, expansion joint by EMSEAL Joint Systems for expansion joints in roof decks and isolation joints in non-traffic, high-movement and seismic structural joint in roof decks. Typical locations include, but are not limited to the following: applications for joints over occupied space, joints across roof lines, and solid slab construction anywhere waterproofed construction is specified. System shall perform waterproofing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system in any way.
- B. Provide RoofJoint as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for horizontal expansion joint locations.
- C. System shall be comprised of:
- 1. Heat weldable, Nitrile PVC or TPV thermoplastic extrusion with dual-level flange.
 - 2. Manufacturer supplied termination bar and anchors.
 - 3. Factory welded downturn transition in the RoofJoint gland that is sealed at a ship lapped 45-degree angle to mate with an interlocking factory-fabricated RoofJoint/SEISMIC COLORSEAL transition piece.
- D. Final selection of the extrusion size to be coordinated between manufacturer, designer, and contractor(s) in consideration of expected movements as a product of structural design and expected temperature variations, taking into account as-built joint-gap sizes and temperatures at expected installation time. Width of joint-gaps at time of casting or cutting to be adjusted, if necessary, from baseline temperature used and specified by designer in determining system suitability.

- E. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

2.7 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.
 - 1. Drain-Tube Assemblies: Equip moisture barrier with drain tubes and seals to direct collected moisture to drain.

2.8 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
- C. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.
- D. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.
- E. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
- F. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.
- H. Moisture Barrier: Flexible elastomeric material, EPDM, minimum 45 mils thick.
- I. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
 - 1. Basis of Design: Subject to compliance with requirements, provide Duragrout by L&M/Laticrete or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- J. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.
- C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 5. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both sides of slabs before installing compression seals.
- E. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
1. Install each length of seal immediately after removing protective wrapping.
 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.
- G. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- H. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- I. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet or where indicated on Drawings.
- 3.4 PROTECTION
- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary

protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 08 0350

RESTORATION OF WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes restoration of wood window and windows in the form of the following:
 - 1. Repairing wood windows and trim.
 - 2. Repairing, refinishing, and replacing hardware. Provide sets that match existing hardware.

1.2 DEFINITIONS

- A. Window: Includes window frame, sash, hardware, storm window, and exterior and interior shutters unless otherwise indicated by context.
- B. Wood Window Component Terminology: Wood window components for historic treatment work include the following classifications:
 - 1. Frame Components: Head, jambs, and sill.
 - 2. Sash Components: Stiles and rails, parting bead, stop, and muntins.
 - 3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
 - 4. Interior Trim: Casing, stool, and apron.
- C. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related restoration of wood windows including, but not limited to, the following:
 - a. Materials, material application, sequencing, tolerances, and required clearances.
 - b. Fire-protection plan.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
 - 1. Include test data substantiating that products comply with requirements.
- B. Shop Drawings: For locations and extent of wood-window repair and replacement work.
 - 1. Include plans, elevations, sections, and details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood window, accessory items, and finishes.
 - 2. Include field-verified dimensions and the following:
 - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relation of existing to new components.
 - b. Templates and directions for installing hardware and anchorages.
 - c. Identification of each new unit and its corresponding window locations in the building on annotated plans and elevations.
 - d. Provisions for sealant joints and flashing as required for location.

- C. Samples for Initial Selection: For each type of exposed wood and finish.
 - 1. Identify wood species, cut, and other features.
 - 2. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for the following, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Replacement Units: 12-inch-long, full-size frame leaf sash exterior trim interior trim sections with applied finish.
 - 2. Replacement Members: 12 inches long for each replacement member, including parts of frame, leaf, exterior trim, and interior trim.
 - 3. Repaired Wood Window Members: Prepare Samples using existing wood window members removed from site, repaired, and prepared for refinishing.
 - 4. Refinished Wood Window Members: Prepare Samples using existing wood window members removed from site, repaired, and refinished.
 - 5. Hardware: Full-size units with each factory-applied or restored finish.
 - 6. Weather Stripping: 12-inch-long sections.
 - 7. Glass: Full-size units of each type and appearance.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For wood-window-repair specialist and wood-repair-material manufacturer.

1.6 QUALITY ASSURANCE

- A. Wood-Window-Repair Specialist Qualifications: A qualified wood window specialist, experienced in repairing, refinishing, and replacing wood windows in whole and in part. Experience only in fabricating and installing new wood windows is insufficient experience for repairing wood windows.
 - 1. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

1.7 MOCKUPS

- A. Mockups: Prepare mockups of window-repair processes to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are as inconspicuous as practicable.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
 - 2. Wood Window Repairs: Prepare one entire window unit to serve as mockup to demonstrate samples of each type of repair of wood window members including frame, sash, glazing, and hardware.
 - 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.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified wood-window-repair specialist to perform preconstruction testing on wood windows.
 - 1. Provide test specimens representative of proposed materials and existing construction.
 - 2. Test repair products and methods for effectiveness and compliance with specified requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.
- B. Store products inside a well-ventilated area, protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with restoration of wood windows only when existing and forecasted weather conditions are within environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 WOOD WINDOW REPAIRS, GENERAL

- A. Quality Standard: Comply with applicable requirements in Section 6, "Interior & Exterior Millwork," in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grades of wood windows, and other requirements unless otherwise indicated.
 - 1. Exception: Industry practices cited in Section 6, Article 1.5, Industry Practices, of the Architectural Woodwork Standards do not apply to the work of this Section.

2.2 REPLICATED WOOD WINDOW UNITS

- A. Replicated Wood Window Frames and Sash: Custom-fabricated replacement wood units and trim, with operating and latching hardware.
 - 1. Joint Construction: Joints matching existing.
 - 2. Wood Species: Match wood species of exterior window trim and sash parts.
 - 3. Wood Cut: Match cut of existing exterior wood window trim and sash parts.
 - 4. Wood Window Members and Trim: Match profiles and detail of existing window members and trim.
 - 5. Glazing Stops: Provide replacement glazing stops coordinated with glazing system indicated.
 - 6. Exposed Hardware: Match existing exposed window hardware.
 - 7. Weather Stripping: Full-perimeter and meeting rail weather stripping for each operable

2.3 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.
- B. Frame Heads and Jambs and Exterior Trim: Match existing species.
- C. Exterior Trim: Match existing species.
- D. Thresholds or Sills: Match existing species.
- E. Leaf Components: Match existing species.
- F. Sills: Match existing species.
- G. Sash Components: Match existing species.
- H. Transoms: Match existing species.
- I. Lites: Match existing species.
- J. Interior Trim: Match existing species.

2.4 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated because of weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
- C. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound to be designed for filling voids in damaged wood materials that have deteriorated because of weathering and decay. Compound to be capable of filling deep holes and spreading to feather edge.

2.5 GLAZING MATERIALS

- A. Glass: See Section 088000 "Glazing."
- B. Glazing Systems:
 1. Modern Glazing Products: Glazing points and single-component polyurethane glazing compound; ASTM C920, Type S, Grade NS, Class 25, Use G; struck uniformly to match taper of existing glazing putty (removed); colored as required to match painted sash.
 2. Primers and Cleaners for Glazing: As recommended in writing by glazing material manufacturer.

2.6 HARDWARE

- A. Hardware: Provide complete sets of hardware for each type of storm window consisting of hinges, pulls, latches, and accessories indicated or required for proper operation. Hardware shall smoothly operate, tightly close, and secure units appropriately for unit weight and dimensions.
- B. Replacement Hardware: Replace existing damaged or missing hardware with new hardware.

- C. Material and Design:
 - 1. Material: Solid bronze of alloy indicated unless otherwise indicated.
 - 2. Design: Custom hardware to replicate existing hardware.
 - 3. Replacement Window Hardware:
 - a. Weight and Pulley Sash-Balance: Concealed weight and pulley balance system including steel or cast iron weights, cast-bronze pulleys, synthetic sash cord bronze sash chain or stainless-steel sash chain; size and capacity to hold sash stationary at any open position.
 - b. Spring Sash-Balance: Concealed tape-spring spiral-tube spring-loaded, or block-and-tackle type; size and capacity to hold sash stationary at any open position.
 - c. Replacement Window Hardware: Match existing window hardware of the following types:
- D. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated by the following:
 - 1. BHMA 624: Dark-oxidized statuary bronze, clear coated; bronze base metal.

2.7 WEATHER STRIPPING

- A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when window is closed.
 - 1. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
 - a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C509.
 - b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C864.
- B. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.

2.8 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; containing no boric acid.
- B. Cleaning Materials:
 - 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
- C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure conditions.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 - 2. Use concealed fasteners for interconnecting wood components.
 - 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
 - 4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
 - 5. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

- E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B633 for SC 3 (Severe) service condition.

2.9 WOOD WINDOW FINISHES

- A. Unfinished Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent materials from damage by historic treatment of wood windows.
- B. Clean wood windows and trim of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting. Note that paint may contain lead and must not be sanded off.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 WOOD WINDOW REPAIR, GENERAL

- A. Have wood window repairs performed only by qualified wood-window-repair specialist
- B. Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from the window interior at 5 ft. away and from the window exterior at 20 ft. away.
- C. Execution of the Work: In repairing wood windows, disturb them as minimally as possible and as follows
 1. Stabilize and repair wood windows to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 2. Remove coatings and apply borate preservative treatment before repair. Remove coatings in accordance with Section 09 0391 "Historic Treatment of Plain Painting" unless otherwise indicated.
 3. Repair items in place where possible.
 4. Install temporary protective measures to protect wood window work that is indicated to be completed later.
 5. Refinish historic wood windows in accordance with Section 09 0391 "Historic Treatment of Plain Painting" unless otherwise indicated.
- D. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.
- E. Repair and Refinish Existing Hardware: Dismantle window hardware; strip paint, repair, and refinish it to match finish Samples; and lubricate moving parts just enough to function smoothly.
- F. Repair Wood Windows: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood windows by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 2. Where indicated, repair wood windows by limited replacement matching existing material.
- G. Replace Wood Units: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
1. Compatible substitute materials may be used.
- H. Protection of Openings: Where windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.
- I. Identify removed windows, frames, leaves, trim, and members with numbering system corresponding to window locations to ensure reinstallation in same location. Key windows, frames, leaves, trim, and members to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.3 WOOD WINDOW PATCH-TYPE REPAIR

- A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.
1. Remove sash storm windows from windows before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated. Reglaze window units only before reinstallation.
 2. Verify that surfaces are sufficiently clean and free of paint residue before patching.
 3. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
 4. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 2. Mix only as much patching compound as can be applied in accordance with manufacturer's written instructions.
 3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
 4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
 5. Clean spilled compound from adjacent materials immediately.

3.4 WOOD WINDOW MEMBER-REPLACEMENT REPAIR

- A. General: Replace parts of or entire wood window members at locations indicated on Drawings and where damage is too extensive to patch.
1. Remove leaves from window frames before performing member-replacement repairs unless otherwise indicated.
 2. Remove sash and storm windows from windows before performing member-replacement repairs unless otherwise indicated.

3. Verify that surfaces are sufficiently clean and free of paint residue before repair.
 4. Remove broken, rotted, and decayed wood down to sound wood.
 5. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
 6. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Glazing: Reglaze units with broken glass before reinstallation.
1. Mill new and rout existing glazed members to accommodate new glass thickness.
 2. Provide replacement glazing stops coordinated with glazing system indicated.
 3. Provide glazing stops to match contour of window frames.
- F. Reinstall units removed for repair into original openings.
- G. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter weather stripping for each exterior leaf.

3.5 GLAZING

- A. Comply with combined written instructions of glass, glazing system, and glazing material manufacturers, unless more stringent requirements are indicated.
- B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.
- C. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.
- D. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.
- E. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.
- F. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.
- G. Install glazing points.
- H. Disposal of Removed Glass: Remove from Owner's property and legally dispose of unless otherwise indicated.

3.6 INSTALLATION OF WEATHER STRIPPING

- A. Install weather stripping for tight seal of joints as determined by preconstruction testing and demonstrated in mockup.

3.7 ADJUSTING

- A. Adjust existing and replacement operating leaves, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Re-install existing storm windows as indicated on the drawings.

3.8 CLEANING AND PROTECTION

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. Monitor window surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact window surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after historic treatment of wood windows. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 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.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

- 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- D. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- E. Samples for Verification:
 - 1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
 - 2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
 - c. Top corner at head / jamb condition, cut sample to show core.
 - 1) corner sample, 12" each leg, unfinished.
- F. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 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. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. 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. Basis of Design: Subject to compliance with requirements, provide products by Ceco Door; ASSA ABLOY or a comparable product by one of the following:
 - 1. Curries Company; ASSA ABLOY.
 - 2. Fleming Door Products Ltd.; Assa Abloy Group Company.
 - 3. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction 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 a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- D. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 - 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- E. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- G. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 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.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated and temperature-rise-rated doors.
 - 3. Frames:
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded unless otherwise indicated.
 - 1) Slip on drywall at in place gypsum board partitions.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with 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
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.

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 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 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. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 5. 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: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: 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.

2.8 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. 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.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. 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.
- J. Glazing: Comply with requirements in Section 08 8000 "Glazing."
- K. 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.

2.9 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: Provide square edges.

4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors 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: 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. Compression Type: Not less than two anchors in each frame.
 - d. 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.
- 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. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 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. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 5. Provide stops for installation 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.

2.10 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.

2.11 ACCESSORIES

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
- C. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- D. 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. 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. 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 or NAAMM-HMMA 840 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. 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.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. 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.
 - 4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 6. 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: Comply with SDI A250.8.
 - 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 with no Threshold: 5/8 inch plus or minus 1/32 inch (0.8 mm).
 - d. At Bottom of Door with Threshold: 3/4 inch plus or minus 1/32 inch.
 - e. 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 8000 "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: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 1613

FIBERGLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes doors and frames of FRP composite construction.
- B. Related Requirements:
 - 1. Section 08 7100 "Door Hardware" for door hardware for Fiberglass doors.
 - 2. Section 08 8000 "Glazing" for glass view panels in fiberglass doors.

1.3 COORDINATION

- A. Coordinate anchorage installation for FRP frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- 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. Locations of reinforcement and preparations for hardware.
 4. Details of each different wall opening condition.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
- D. Samples for Initial Selection: For FRP doors and frames with factory-applied color finishes.
- E. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
 2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed FRP panels and glazing if applicable.
 - c. Top corner at head / jamb condition, cut sample to show core.
 - d. Corner sample, 12" each leg, unfinished.
- F. Schedule: Provide a schedule of Fiberglass 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 Fiberglass door assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Experience: Manufacturer shall be ISO 9001 certified and been engaged in the manufacture of Fiberglass door systems for a minimum of five (5) years documented experience prior to the start of this work, and who has a history of successful production acceptable to the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. FRP doors and frames are delivered to your site in boxes with foam sheet separations.
- B. Store FRP 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.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of FRP door and frames 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. Deterioration of finishes, and other materials beyond normal weathering.
 - c. Failure of operating components.
 2. Warranty Period: 10 years.

- a. 10-year warranty covering parts and labor; limited lifetime warranty covering failure of corner joinery, core deterioration, delamination or bubbling of door skin

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide doors by Special-Lite Inc, or a comparable product by one of the following:
 - 1. Curries
 - 2. Plastpro
- B. Source Limitations: Obtain Fiberglass work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Provide rated assembly as indicated on the drawings.
 - 1. Fire-rated door and panel construction conforms to products tested under ASTM E152, UL10C & NFPA 252.
 - 2. Flame Spread: All rated Fiberglass component parts, including the finish, shall have a flame spread classification of 25 or less per ASTM E84 and shall be self-extinguishing per ASTM D635, unless operating conditions dictate otherwise
- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- C. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 - 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- F. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- G. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- H. Additional Low-emitting requirements –Thermal and Acoustic Insulation

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 2. Methylene chloride and perchloroethylene shall not be intentionally added in insulation products.
- I. Sustainability Requirements:
1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 CONSTRUCTION

- A. Door Thickness: 1-3/4".
- B. Stiles & Rails.
1. Aluminum extrusions made from 6063-T6 aluminum alloys with a minimum temper of T5.
 2. Minimum 2-5/16" deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
 3. Screw or snap in place applied caps are not acceptable.
 4. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
 5. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
 6. Meeting stiles to include integral pocket to accept pile brush weather seal.
- C. Corners.
1. Mitered.
 2. Secured with 3/8" diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
 3. 1-1/4" x 1-1/4" x 3/16" 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
 4. Weld, glue, or other methods of corner joinery are not acceptable.
- D. Core:
1. Poured-in-place polyurethane foam
 - a. The polyurethane insulation shall be Class A and CFC free. Foam properties comply with ASTM E-84 and The International Building Code (IBC).
 - b. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.
- E. Face Sheet.
1. Exterior
 - a. 0.120" thick, through color FRP sheet.
 - b. Class C standard.
 2. Interior
 - a. 0.120" thick, through color FRP sheet.
 - b. Class C standard optional Class A available consult manufacturer.
 3. Attachment of face sheet.
 - a. Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
 - b. Use of glue to bond face sheet to core or extrusions is not acceptable.
- F. Cutouts: Manufacture doors with cutouts for required vision lites, louvers, and panels.

- G. Reinforcements.
 - 1. Aluminum extrusions made from 6063-T6 aluminum alloys.
 - 2. Sheet and plate to conform to ASTM-B209.
 - 3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
 - 4. Bars and tubes to meet ASTM-B221.

2.4 FRAMING

- A. Aluminum Tube Framing with Applied Stops.
 - 1. Perimeter Frame Members.
 - a. Box type with 4 enclosed sides.
 - b. Factory fabricated.
 - c. Open-back framing is not acceptable.
 - 2. Applied Door Stops.
 - a. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
 - b. Provide solid 1/2" aluminum bar behind door stop for closer shoe attachment.
 - c. Pressure gasketing for weathering seal.
 - d. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
 - 3. Caulking.
 - a. Caulk joints before assembling frame members.
 - 4. Frame Member to Member Connections.
 - a. Secure joints with fasteners.
 - b. Provide hairline butt joint appearance.
- B. Thermally Broken Aluminum Framing.
 - 1. Storefront frame with thermally broken pocket filler as per spec section 08 4113.
- C. Standard FRP Frames
 - 1. Perimeter Frame Members.
 - a. 3/16" thick pultruded fiberglass open throat with return.
 - b. Factory fabricated.
 - c. 2" or 4" face available for frame headers.
 - 2. Transoms and Sidelites.
 - a. Same as perimeter frame members.
 - b. Removable stop for 1/4", 5/8" or 1" glass or panels.
 - 3. Integral Door Stops.
 - a. 5/8" x 2-1/4".
 - 4. Frame Assembly.
 - a. Single frames chemically welded at factory.
 - b. Pairs knock down for field assembly.
 - 5. Frame Member to Member Connections.
 - a. Corners mitered with 4" x 4" x 3/8" pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.
 - b. All member to member connections chemically welded at factory unless in a knock down configuration.
 - c. Provide hairline butt joint appearance.
 - 6. Reinforcements.
 - a. 1/4" thick pultruded FRP chemically welded to frame at all hinge, strike, and closer locations.

2.5 FASTENERS

- A. All fasteners for all hardware shall be type 304 CRSS (18-8 series corrosion resistant stainless steel). No carbon steel or aluminum components shall be used.

2.6 HARDWARE

- A. Doors shall be factory mortised and drilled for mortise template butt hinges, with #12x2" long stainless steel screws provided for hinge attachment. Provide 161 cylindrical lock bore, rim deadbolt, ANSI 86 mortise lock edge prep and pocket, or flush-bolt cutouts as required.
- B. Frames shall be factory machined and drilled for all hardware requiring mortises, with #12x1" long stainless steel screws pre-installed for hinge attachment.
- C. Hardware shall be furnished as so designated in appropriate section and shall be coordinated and installed by experienced mechanics.
- D. Supplier shall furnish manufacturer's standard templates, installation instructions, or full size approved door and frame preparation instructions as approved by the architect and as required by door and frame manufacturer prior to door and frame factory initiated manufacture. Standard factory lead-time for production of FRP doors and frames shall commence only and when all distributor required preparation information is received and acknowledged by the door and frame manufacturer.

2.7 FINISH

- A. Polyurethane finish, high solids polyurethane topcoat that exhibits excellent chemical resistance, outstanding toughness, flexibility, abrasion resistance and excellent outside durability.
 - 1. Matte; all face sheet options.
 - 2. Topsheet finish to match existing school blue color.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which fiberglass reinforced plastic work is to be installed and notify in writing of any conditions detrimental to the proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION

- A. General: Install Fiberglass work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Install FRP doors, frames and accessories in accordance with manufacturers printed instructions, final shop drawings, NFPA 80 standards at fire rated openings and / or HVHZ standards for FBC labeled openings.
- C. FRP Frames: Install FRP frames of size and profile indicated.

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.
 2. Install in strict accordance with manufacturer's printed instructions. Set plumb and square, using shims for bolt-in of existing openings, or wood bracing prior to grouting of jambs. Use at least two 2x6 wood spreaders inside frame to maintain critical opening dimensions during grouting.
- D. FRP Doors: Fit FRP doors accurately in frames, within clearances specified below. Shim as necessary.
1. Hang per manufacturer's printed instructions using special screws provided for hinge attachment. Install doors to swing freely and to stand open at any angle. After installation make final adjustments to hardware to allow for proper door operation and latching. All surface applied hardware shall be thru bolted.
- E. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with FRP manufacturer's written instructions. Units to be factory glazed.

3.3 ADJUSTING

- A. Adjust all operable components to ensure proper installation. Doors shall function smoothly and swing freely without binding. Doors shall remain open at any angle without being affected by gravitational influence.

3.4 CLEANING AND TOUCHUP

- A. Remove dirt and excess sealant from exposed surfaces. Follow the manufacturer's recommended cleaning techniques and procedures for cleaning all surfaces. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer.

END OF SECTION

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 07 7200 "Roof Accessories" for roof hatches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- D. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- E. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following sections:
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Babcock-Davis.
 - 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 3. Larsen's Manufacturing Company.
 - 4. MIFAB, Inc.
 - 5. Milcor
 - 6. Nystrom, Inc.
 - 7. Williams Brothers
 - 8. Wind-Lock Corp
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Concealed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As required.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 - 5. Stainless-Steel Sheet for Door: Nominal 0.062 inch, 16 gage.
 - a. Finish: No. 4.
 - b. At wet halls.
 - 6. Frame Material: Same material and thickness as door.
 - 7. Hinges: Manufacturer's standard.
 - 8. Hardware: Latch.
- D. Interior Flush GFRG Access Doors with Concealed Flanges:
 - 1. Description: Face of concealed-hinge door flush with frame, with concealed flange for gypsum board installation.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: 2 x 2 feet unless otherwise indicated.
 - 4. Door Type Concealed-hinge, radius corner.
 - 5. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
 - 6. Latch and Lock: Cam latch, key operated, with interior release.

2.3 BASEMENT ACCESS DOOR

- A. Basement Access Doors:
1. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick fiberglass insulation.
 2. Locations: Wall.
 3. Door Size: as indicated.
 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

2.4 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
1. Babcock-Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. Larsen's Manufacturing Company.
 4. MIFAB, Inc.
 5. Nystrom, Inc.
- B. Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob, with interior release.
- C. Hardware:
1. Latch: Cam latch operated by screwdriver.

2.5 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. 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.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

- G. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- H. Frame Anchors: Same type as door face.
- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.6 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 4413

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Glazed aluminum curtain walls.
 - 2. Aluminum Entrances.
- B. Related Requirements:
 - 1. Section 07 8443 "Joint Firestopping" perimeter fire-containment systems (safing insulation) field installed with glazed aluminum curtain walls.
 - 2. Section 07 9200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 3. Section 08 8000 "Glazing" for curtain wall glazing.
 - 4. Section 08 4433 "Sloped Glazing Assemblies" for sloped glazing.

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 construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, provide the following information when available:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Indicate locations of custom curtain wall supports at lateral anchors.
 - 2. Show devices and embedded items.

3. Show water management and weep locations and details.
 4. Provide details of perimeter conditions and typical joinery. Indicate which framing members run through and how joints are sealed.
 5. Provide details of transition areas and modifications to standard system components.
 6. Provide details of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 7. Indicate building column line reference dimensions.
 8. Provide reaction loads imposed on the structure, including all deadload, seismic, and windload reactions at each anchor location.
 9. Provide all shop drawings bearing dimensions of actual measurements taken at the project.
 10. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 11. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 12. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 13. Submit System U-Value for each condition, with each glass type
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule: Prepared by or under 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.
- G. Delegated-Design Submittal: For glazed aluminum 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. Submit design modifications for project-specific conditions to meet performance requirements and field coordination prior to fabrication, if necessary. Maintain general design concept without altering profiles and alignments shown, including tolerance.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer and field testing agency.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Provide Mock-up Panel as indicated on drawings and as detailed in Section 01 4000 "Quality Requirements".
 - a. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall 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 and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.

- e. 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 Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
- 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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, peeling, or chipping.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- 1. Glazed aluminum curtain walls shall withstand movements of supporting structure 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.
- C. Structural Loads:
- 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
- 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

- E. Structural: Test 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, or 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.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 - 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..
 - 2. 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, or water that is drained to exterior.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient:
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.35 as determined according to NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.25 as determined according to NFRC 200.
 - 3. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined according to AAMA 1503.
 - b. Entrance Doors: CRF of not less than 68 as determined according to AAMA 1503.
- J. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 - 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2. Thermal Cycling: 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.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - L. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
 - M. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - N. Low-emitting requirements – Interior Products
 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
 - O. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - P. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- 2.2 MANUFACTURERS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide 1600 Series, System 1, by Kawneer Company or comparable product by one of the following:
 1. Oldcastle Building Envelope.
 2. YKK AP America Inc.
 - B. Source Limitations: Obtain all components of curtain wall system, including framing spandrel panels entrances and accessories, from single manufacturer.
- 2.3 FRAMING
- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Thermally broken.
 2. Glazing System:
 - a. Retained mechanically with gaskets on four sides
 - b. Retained mechanically with gaskets on two sides and structural sealant on two sides.
 3. Glazing Plane: Front.
 4. Finish: High-performance organic finish.
 5. Fabrication Method: Either factory- or field-fabricated system.

- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - 1. Include snap-on aluminum trim that conceals fasteners.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Exterior Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - b. Basis of Design: Insulpour 350T by Kawneer
 - 2. Door Design: Medium stile; 3½-inch nominal width.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - 4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 7100 "Door Hardware."

2.6 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.7 ACCESSORIES

- A. 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 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- E. Engineered Transition Assemblies
1. Air Barrier Perimeter Seal to Windows, Doors, Curtain wall and Storefront Systems:
 2. Products:
 - a. Proglaze Engineered Transition Assembly (ETA), manufactured by Tremco, Inc
 - b. Pecora's XL-Transition System using Pecora's XL-Span 100% Silicone Extruded Transition Membrane and AVB silicone sealant.
 3. Provide one of products listed, evaluated in accordance with the following properties:
 - a. ASTM E 283 Test Method for Determining Rate of Airflow Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
 - b. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Curtain Wall and Doors by Uniform Static Air Pressure Differential
 - c. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air pressure Difference
 - d. ASTM E 547 Test Method for Water penetration of Exterior Windows, Curtain walls and Doors by Cyclic Static Air Pressure Difference

2.8 ALUMINUM BRAKE-METAL AND TRIM WORK

- A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the work as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with the Work of this Section.
1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable. Provide sharp bends in formed work without tearing, cracking, or grain separation of base metal.
 2. Provide sheet metal panning not less than 0.125 inch thick. Reinforce panning as required to prevent oil canning.
 3. Fasten trim clips, at not more than 16 inches on center.
- B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent "oil canning" or deformation of the finished work. Material deemed defective by the architect will be replaced at no cost to the Owner.

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. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Prepare surfaces that are in 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 Section 08 8000 "Glazing."
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 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.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 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.
- I. 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.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: To be selected by Architect from Manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - 7. Seal joints watertight unless otherwise indicated.
- B. During installation coordinate and sequence work with air barrier subcontractor to ensure air barrier membrane is in place for transition to curtain wall framing at all head, jamb and sill locations. Curtain wall installer is responsible for installation of engineered transition assembly between air barrier membrane and curtain wall framing. Installation shall ensure that the air barrier is a continuous and airtight connection between the adjacent building envelope elements and the curtain wall system, and capable of withstanding deflection and air pressure movement. Coordinate all work with Division 07 Section "Nonbituminous self-Adhering Air Barriers".
- C. Protect Air barrier during construction and protect work from damage. Any damage caused to air barriers that compromises building performance will be corrected by air barrier original installer, with costs paid by subcontractor who caused the original damage.
- D. Metal Protection:
 - 1. Where aluminum is in contact with 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 is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- E. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- F. Sealant: Control curing process of newly placed sealant and prevent prolonged exposure to sunlight as required to allow for proper curing. Install all sealants free of contaminated substances, in a uniform, continuous smooth application without air gaps or voids, regardless of abutting surface profiles. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

- G. Install components plumb and true in alignment with established lines and grades.
- H. Install glazing as specified in Section 08 8000 "Glazing."

3.3 INSTALLATION OF ALUMINUM ENTRANCE DOORS

- A. Install entrance 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.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.
- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - 2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - 3. Water Penetration: ASTM E 1105 at a minimum static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 08 5113

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes aluminum windows for exterior locations.
- B. Related Requirements:
 - 1. Section 08 4113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
 - 2. Section 08 4413 "Glazed Aluminum Curtain Walls" for installation of project out window.

1.3 PREINSTALLATION MEETINGS

- A. 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 and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
 - 3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
 - 4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Product Data: For adhesives and sealants indicating compliance with VOC content requirements.
- C. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

- D. Shop Drawings: For aluminum windows.
 - 1. Include plans, elevations, sections, hardware, accessories, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- E. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
- F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - 1. Provide the Mock-ups of typical windows as directed by Architect.
 - 2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 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 undamaged at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver 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. Store 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.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.

- b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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, peeling, or chipping.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: AAMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Performance Class and Grade: AW-PG60-FW
- C. Thermal Transmittance Test (U-Factor): When tested in accordance with AAMA 1503, the conductive thermal transmittance (U-Factor) shall not be more than .58 BTU/hr/sf/°F or .40 BTU/hr/sf/°F per AAMA 507 or NFRC100 when using project specified glass.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.
- E. Condensation Resistance Test (CRF): When tested in accordance with AAMA 1503 with clear glass, the condensation resistance factor (CRF) shall not be less than (CRFf 59) frame and (CRFg 57) glass.
- F. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 - 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- G. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

- H. Sound Performance: as indicated on exterior glazing schedule on drawings.
- I. Thermal Barrier Tests: Testing shall be in general accordance with AAMA 505 Dry Shrinkage and Composite Thermal Cycling test procedure, AAMA TIR-A8, Structural Performance of Composite Thermal Barrier systems.
- J. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- K. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- L. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- M. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 ALUMINUM WINDOWS

- A. Basis of Design: Subject to compliance with requirements, provide 8400TL Thermal Window by Kawneer or a comparable product by the following:
 - 1. Oldcastle Building Envelope.
 - 2. Schuco USA
 - 3. YKK AP America Inc.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Horizontal sliding windows
 - 2. Fixed
- C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- D. Glazing: Satisfy requirements specified in Section 088000 Glazing.
 - 1. Kind: Fully tempered where indicated on Drawings and where required by authorities having jurisdiction.
- E. Hardware, General: All window hardware shall be Bronze Craft (BC) unless indicated otherwise below.
 - 1. Exposed Hardware Color and Finish: BC aluminum-bronze alloy C95500 with polished satin finish
 - 2. Non-magnetic stainless steel (18-8). Rivets securing the vent arm shall be brass.
 - 3. Manufacturer shall drill and tap for window restrictor blocks. Number of restrictor blocks provided by manufacturer to be determined with input from Buildings + Grounds:

generally restrictor blocks shall be provided at windows which open into the path of travel (CBC and ADA requirement), ground-floor windows (for security) and upper-floor windows (for safety).

- F. Horizontal-Sliding Window Hardware:
 - 1. Sill Cap/Track: Manufacturer's standard of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
 - 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 - 3. Roller Assemblies: Low-friction design.
- G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.

2.7 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 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 openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Inspect aluminum windows upon delivery. Do not accept damaged or defective window units, or window units whose packaging is damaged. Fenestration product should be true-to-line, unbent, and manufactured in accordance with approved shop drawings.
- C. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
 - 1. Provide receptor at clerestory windows.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
 - 5. Test at 10%, 50%, and 90% completion.
 - 6. Test Reports: Prepared according to AAMA 502.
- C. Windows will be considered defective if any do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 6200

UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed curb mount unit skylight with formed curb counterflashing for mounting on prefabricated roof curbs, for flat, low-slope and steep-slope roofing applications.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of unit skylight.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.
 - 2. Motors: Show nameplate data, power requirements, ratings, characteristics, and mounting arrangements.
 - 3. For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- C. Shop Drawings: For unit skylight work.
 - 1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
 - 2. Multiple Units: Methods of connection and structural support for multiple units clustered together.
- D. Aluminum Finish Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.
- E. Glazing Samples: For each color and finish of glazing indicated, 12 inches square and of same thickness indicated for the final Work.

- F. Product Schedule: For unit skylights. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For unit skylights to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship under normal use within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, dome, and other materials beyond normal weathering.
 - b. Breakage of glazing.
 - 2. Warranty Period:
 - a. Unit Skylight and Flashing Product Warranty: 10 years from date of purchase.
 - b. Unit Skylight and Flashing Installation "No Leak" Warranty: 10 years from date of purchase.
 - c. Hail Breakage Warranty for Skylight Glass: 10 years from the date of purchase on all insulated glass units using laminated glass.
 - d. Insulating Glass Seal Failure Warranty: 20 years from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Ameriforce 100 Curb mount by American Skylight or comparable product by one of the following:
 - 1. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

- A. Air Leakage: Metal-framed skylights with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of when tested in accordance with ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..
- B. Water Penetration under Static Pressure: Metal-framed skylights that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 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..
- C. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 - 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- D. OSHA Protection for roof openings
 - 1. OSHA Fall Protection Guidelines: OSHA 29 CFR 1910.29 & 1926.501 Fall Protection Protocols Required for Roof Openings with no additional coverage/screen required:
 - 2. Skylight Assembly must be capable of supporting, without failure, at least twice the maximum intended load that may be imposed on the cover at any one time. Maximum intend load for this installation is defined as 200 lbs, which translates to supporting, without failure, 400lbs imposed on the cover at any one time, which is in accordance with California State OSHA Fall Protection Code of Regulations for this application.
- E. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- F. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- G. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- H. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 UNIT SKYLIGHTS

- A. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.
- B. System Description: Fixed curb mounted unit skylight with a roll-formed aluminum frame counter-flashing joined by corner keys, an interior condensation drainage gasket, an insulated glass unit, structural sealant, mounting fasteners, flashing and accessories, as required to meet

installation and performance requirements indicated. FCM skylights shall be suitable for installation on roof curbs ranging from 0 degrees up to 60 degrees from horizontal.

- C. Unit Shape and Size: As indicated.
- D. Glazing Gaskets: Manufacturer's standard.
- E. Prefabricated Curb: As specified in Section 07 7200 "Roof Accessories."
- F. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.
- G. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.
- H. Protective Screens: Manufacturer's standard to protect against falling glass and windborne debris.

2.4 GLAZING

- A. Acrylic Glazing: ASTM D4802 thermoformable, type UVT sheets allowing for the transmission of UVB while resisting the yellowing, clouding that can ultimately reduce the amount of ultraviolet rays passing through.
 - 1. Acceptable Manufacturers:
 - a. Solarcyl SUVT by Spartech Polycast: 800-243-9002.
 - b. Acrylite OP-4 by Cyro Industries: 203-795-6081.
 - c. Optix L Ultran by Plaskolite.

2.5 ACCESSORY MATERIALS

- A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.
 - 1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. 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 openings, substrates, structural support, anchorage, 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. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
- B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.
- C. Install unit skylights level, plumb, and true to line, without distortion.
- D. Anchor unit skylights securely to supporting substrates.
- E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of unit skylights.
- C. Field Quality-Control Testing: Perform the following test on representative areas of unit skylights.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect, on 1 unit.
 - 2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - a. Perform a minimum of two tests in areas as directed by Architect, on 1 unit.
 - 3. Water Penetration: ASTM E 1105 at a minimum static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- D. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.
- E. Perform test for total area of each unit skylight.
- F. Work will be considered defective if it does not pass tests and inspections.
- G. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- H. Prepare test and inspection reports.

3.4 CLEANING

- A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.
- B. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to proposers but will not be part of Contract Documents, as follows:
- B. Original Odenheimer Drawings; *The Odenheimer Aquarium for Audubon Park*; dated 1-6-1923
- C. Odenheimer Architectural Renovations; *Audubon Park & Zoological Garden Odenheimer Complex Architectural Renovations*; dated 12-19-1986
- D. Komodo Dragon Exhibit; Komodo Dragon Exhibit Audubon Park Zoo; dated 10-15-1996

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
 2. Sliding doors.
 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
 2. Electromechanical door hardware.
 3. Automatic operators.
 4. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames".
 2. Division 08 Section "Flush Wood Doors".
 3. Division 08 Section "Sound Control Hollow Metal Door Assemblies".
 4. Division 08 Section "Sound Control Wood Door Assemblies".
 5. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 6. Division 08 Section "Fire-Rated Steel Framed Entrances".
 7. Division 08 Section "Automatic Door Operators".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 2. ICC/IBC - International Building Code.
 3. NFPA 70 - National Electrical Code.
 4. NFPA 80 - Fire Doors and Windows.
 5. NFPA 101 - Life Safety Code.
 6. NFPA 105 - Installation of Smoke Door Assemblies.
 7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.

8. State Building Codes, Local Amendments.

- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Hardware Supplier and Hardware Installer must obtain a license with the Louisiana Office of State Fire Marshall in accordance to RS 40:1464 and RS 40:1664.
- B. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- C. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

- D. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.
- E. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:..

- a. Hager Companies (HA).
- b. Pemko (PE).

2.4 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko (PE) - SER-QC (# wires) Option.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. Hager Companies (HA) - Quick Connect.
- b. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

- 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
- 2. Furnish dust proof strikes for bottom bolts.
- 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
- 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
- 5. Manufacturers:

- a. Ives (IV).
 - b. Rockwood (RO).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
 - 6. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).

2.6 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.

2.9 MULTI-POINT LOCKS AND LATCHING DEVICES

A. Multi-Point Locksets: Vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.

- b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
 - d. Five-year limited warranty for mechanical functions.
- 2. Electromechanical locksets shall have the following functions and features:
 - a. Motor driven electric latch retraction that supports electrified dogging.
 - b. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable to fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - c. Uses standard electric hinge; no special power transfer required.
 - d. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
- 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - MP9800 Series.
 - b. Sargent Manufacturing (SA) - 7000 Series.

2.10 DEADLOCKS AND LATCHES

- A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8" diameter bolts.

- 1. Manufacturers:
 - a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.
 - b. Adams Rite Manufacturing (AD) - 4900 Series.

2.11 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 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: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
12. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. No catch points: addition of applied deflectors or other added components are not allowed.
 - d. No visible plastic.
 - e. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
 - f. Constructed of all stainless steel.
 - g. Stainless steel pullman type latch with deadlock feature.
 - h. Narrow or wide style exterior trim as specified in the hardware sets.
 - i. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
 - j. Ten-year limited warranty for mechanical features.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
 - b. Sargent Manufacturing (SA) - PE80 Series.

2.13 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy

body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Sargent Manufacturing (SA) - 351 Series.

2.14 ELECTROMECHANICAL DOOR OPERATORS

- A. Electromechanical Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 and UL10C certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Activation by push button, hands-free or radio frequency devices.
 - c. Adjustable opening force and closing power.
 - d. Two-year limited warranty.
 - e. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
 - f. Mounting backplate to simplify and speed up installation.
 - g. Integration with access control systems.
2. Operators shall have the following functionality:
 - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
 - c. Emergency Interface Relay: Door closes and ignores any activation input until signal is discontinued.
 - d. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - e. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.

- f. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
- g. Open Delay: Delays operator opening for locking hardware.
- h. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.
- i. Power Assist: Senses the door is being opened manually and applies small amount of power to assist the user in opening the door with force less than 5 lbs. The door opens only as far as it is moved manually, then closes once released.
- j. Power Close: Additional force to assist door closing between 7° and 2°.
- k. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
- l. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
- m. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
- n. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
- o. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.

3. Manufacturers:

- a. Norton Rixson (NO) - 6300 Series.

2.15 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door Protective Trim:

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:

- a. Ives (IV).
- b. Rockwood (RO).

2.16 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.17 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko (PE).

2.18 ELECTRONIC ACCESSORIES

- A. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 1. Power supplies shall meet all functions and features as specified herein.
 - a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
 - b. Tolerates brownout or overvoltage input $\pm 15\%$ of nominal voltage.
 - c. Thermal shutdown protection with auto restart.
 - d. Circuit breaker protection against overcurrent and reverse battery faults.
 - e. Integrated battery charging circuit to prevent overvoltage on locking devices.
 - f. Available with a single relay fire trigger or individually triggered relayed outputs.
 - g. Monitoring options as specified.
 2. Manufacturers:
 - a. Altronix (AS) - Maximal 3.
 - b. Securitron (SU) - AQD Series.

2.19 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. AD - Adams Rite
4. SA - SARGENT
5. YA - ASSA ABLOY ACCENTRA
6. RO - Rockwood
7. OT - Other
8. RF - Rixson
9. NO - Norton
10. SU - Securitron

Hardware Sets based on plans dated 12/18/2025

Set: 1.0

Doors: 307A, 307B

Description: EXT SGL- ALUM - EAC - Auto Operator

1 Continuous Hinge (Elec)	CFMXXHD1 SER	PE	⚡
1 Rim Exit MELR / RX / Hex	LC 55 HK56 PE8504 Less Pull	US32D	SA ⚡
1 Cylinder	Type as req'd - match existing		YA
1 Pull	Handle Shop Couture -HARRY 39"	Bronze	OT
1 Automatic Opener	6300 Series As Required	689	NO ⚡
1 Gasketing	by door / frame mfg		

1 Threshold	2005AT MSES25SS	PE
1 ElectroLynx Harness	QC-C1500 [PS to hinge]	MK ⚡
1 ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]	MK ⚡
2 Door Switch	503	NO ⚡
1 Power Supply	AQD SIZE AS REQUIRED	SU ⚡

Notes: Door normally closed and latch.

Activation of push button retracts latch and cycles operator to open door for predetermined amount of time.

Exterior operator switch deactivated outside of business hours by access control system.

Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 2.0

Doors: 308

Description: EXT PR - ALUM - EAC - Auto Operator

2 Continuous Hinge (Elec)	CFMXXHD1 SER	PE ⚡
1 CVR MELR - HK Dog	HK LC 55 56 ADPE8410 P106 x Less Pull	US32D
SA	⚡	
1 CVR RX/DT	55 ADPE8410 862	US32D SA
1 Cylinder	Type as req'd - match existing	YA
2 Pull	Handle Shop Couture -HARRY 39"	Bronze OT
1 Surface Closer	351 CPS Brkt/spacer as req.	EN SA
1 Automatic Opener	6300 Series As Required	689 NO ⚡
2 Door Stop	467-RKW	BLK RO
1 Gasketing	by door / frame mfg	
1 Threshold	2005AT MSES25SS	PE
2 ElectroLynx Harness	QC-C1500 [PS to hinge]	MK ⚡
2 ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]	MK ⚡
2 Door Switch	503	NO ⚡
1 Power Supply	AQD SIZE AS REQUIRED	SU ⚡

Notes: Door normally closed and latch.

Activation of push button retracts latch and cycles operator to open RHR door for predetermined amount of time.

Exterior operator switch deactivated outside of business hours by access control system.

Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 3.0

Doors: 401

Description: PR EXT- LOCK - OH HOLD

2 Continuous Hinge	CFMXXHD1	PE
2 Surface Bolt	988	Bright Zinc SA

DOOR HARDWARE
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1 Storeroom Deadbolt Lock	LC 8251 LNL	US15	SA
1 Cylinder	Type as req'd - match existing		YA
2 Surf Overhead Hold Open	10-x26	689	RF
2 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Astragal	By the door manufacturer		OT
1 Gasketing	303AS		PE
2 Sweep	315CN		PE
1 Threshold	2005AT MSES25SS		PE

Notes: Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 4.0

Doors: 102

Description: SGL EXT - LOCK - INSWING - HC

1 Continuous Hinge	CFMXXHD1		PE
1 Storeroom Deadbolt Lock	LC 8251 LNL	US15	SA
1 Cylinder	Type as req'd - match existing		YA
1 Surface Closer	351 UO	EN	SA
2 Kick Plate	K1050 10" BEV CSK	US15	RO
2 Door Stop	409 / 446 as required	US32D	RO
1 Gasketing	303AS		PE
1 Sweep	315CN		PE
1 Threshold	1715A		PE

Notes: Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 5.0

Doors: 304B

Description: SGL EXT - LOCK - OUTSWING - HC - RAG LEVER

1 Continuous Hinge	CFMXXHD1		PE
1 Storeroom Deadbolt Lock	LC 8251 LNRAG	630	SA
1 Cylinder	Type as req'd - match existing		YA
1 Surface Closer	351 CPS Brkt/spacer as req.	EN	SA
2 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Gasketing	303AS		PE
1 Rain Guard	346C		PE
1 Sweep	315CN		PE
1 Threshold	2005AT MSES25SS		PE

Notes: Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 6.0

Doors: 302A, 303

Description: EXT SGL PUSH/PULL DB - HC

1 Continuous Hinge	CFMXXHD1		PE
1 Threshold Bolt	4015		AD
1 Header Bolt	4016		AD
1 Mortise Deadlock	MS1850S Schoolhouse Function	628	AD
1 Cylinder	Type as req'd - match existing		YA
2 Push Bar - BTB	RM3522-18 Mtg-Type 5HD	US32D	RO
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Door Stop	409 / 446 as required	US32D	RO
1 Gasketing	303AS		PE
1 Sweep	315CN		PE
1 Threshold	1715A		PE

Notes: Hardware products meet Windstorm design intent ONLY. Confirm hardware meets Windstorm assembly requirements per door manufacturer which may differ from what was used for specification. Confirm all hardware compatibility with door manufacturer.

Set: 7.0

Doors: 304A

Description: EXT PR - MULTIPOINT LOCK - OUTSWING - RAG LEVER

2 Continuous Hinge	CFMXXHD1		PE
2 Multi-Point Lock	HC LC 701315 ETRAG	630	SA
2 Cylinder	Type as req'd - match existing		YA
2 Surface Closer	351 CPS Brkt/spacer as req.	EN	SA
2 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Astragal Set (2)	303AS		PE
1 Gasketing	303AS		PE
1 Rain Guard	346C		PE
2 Sweep	315CN		PE
1 Threshold	2005AT MSES25SS		PE

Set: 8.0

Doors: 309, 310, 311

Description: SGL - LOCK - STOREROOM - CLOSER/STOP - GASKET

3 Hinge, Full Mortise	TA2714	US15	MK
1 Storeroom/Closet Lock	LC 8204 LNL	US15	SA
1 Cylinder	Type as req'd - match existing		YA
1 Surface Closer	351 PS	EN	SA
1 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Gasketing	S88BL		PE

Set: 9.0

Doors: 302B

Description: SGL - LOCK - STOREROOM - CLOSER - GASKET- RAG LEVER

3 Hinge, Full Mortise	TA2714	US15	MK
1 Storeroom/Closet Lock	LC 8204 LNRAG	630	SA
1 Cylinder	Type as req'd - match existing		YA
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" BEV CSK	US15	RO
1 Door Stop	409 / 446 as required	US32D	RO
1 Gasketing	S88BL		PE

Set: 10.0

Doors: 101A, 101B

Description: SPECIALTY

2 Continuous Hinge	CFMXXHD1		PE
2 Pull	853	US32D	RO
1 Gasketing	303AS		PE
1 Balance of hardware	By the door manufacturer		OT

Set: 11.0

Doors: 403

Description: SPECIALTY PR - THRESHOLD

2 Continuous Hinge	CFMXXHD1		PE
2 Pull	853	US32D	RO
1 Gasketing	303AS		PE
1 Threshold	2005AT MSES25SS		PE
1 Balance of hardware	By the door manufacturer		OT

END OF SECTION 087100

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass products.
 - 2. Laminated glass.
 - 3. Insulating glass.
 - 4. Glass with decorative film overlay.
 - 5. Glazing sealants.
 - 6. Glazing tapes.
 - 7. Miscellaneous glazing materials.

- B. Related Sections:
 - 1. Section 08 8300 "Mirrors."

1.3 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. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 PREINSTALLATION MEETINGS

- A. 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.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
 - 1. Submit System U-Value for each condition, with each glass type
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Data:** For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. **Building Product Disclosure Requirements:** To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings:
 - 1. Submit scaled shop drawings showing layout, jointing, anchoring sizes and types, shapes, thickness, and other detailed information needed to fully describe fabrication and installation
 - 2. Shop drawing submittal package shall be coordinated with submission of related portions of Work (i.e. Storefront, Curtain wall, skylights)
- D. Test Reports:
 - 1. Stress and thermal analysis of glass
 - 2. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant, and other glazing materials including insulating units
- E. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 - 1. Coated glass.
 - 2. Laminated glass.
 - 3. Insulating glass.
 - 4. Spandrel glass.
 - 5. Each decorative film overlay on type of decorative glass.
- F. Glazing Accessory Samples: For gaskets sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- G. Glazing and Sealant Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- H. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.
- I. Submit calculations specific to glass sizes and thickness and heat treatments that glass will meet design load requirements for this building
 - 1. Perform and submit thermal stress analysis for each glass type and size at each building elevation taking into account shading effects. Append to thermal stress analysis a

statement from glass manufacturer that based upon this analysis that resulting thermal stresses will not reduce specified statistical probability of breakage

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency and sealant testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for 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.
- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified 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. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in other Division 8 sections to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not 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 enough 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. All tempered Glazing units and glazing units larger than 50 square feet shall be 100% heat soak tested per EN 14179-2016 in calibrated oven.
 1. Records must be kept of heat soaking for each batch for QA/QC purposes and made available to the Architect on request. Such records shall include, as a minimum, the following:
 - a. Traceability of glass, i.e. source of supply and evidence of batching.
 - b. Dates of tempering/heat soaking.
 - c. Certification that the glass will meet the performance requirements of this Specification.
 - d. Records to include details of all units that failed during the heat soak test.
- 1.10 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.
- 1.11 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.
- 1.12 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. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

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

PART 2 - PRODUCTS

2.1 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: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
 2. Design Snow Loads: As indicated on Drawings.
 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, whichever is less.
 4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 2.
1. Large-Missile Test: For glazed openings located within 30 feet of grade.
 2. Small-Missile Test: For glazed openings located more than 30 feet above grade.
- E. Safety Glazing: Provide safety glazing where required by code that complies with 16 CFR 1201, Category II.
- F. 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 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 the latest non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on the latest non-beta version of LBL's WINDOW computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

- G. Sound Rating: Provide sound control assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 - 1. STC Rating: As indicated on Drawings as calculated by ASTM E 413 when tested in an operable condition according to ASTM E 90
- H. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- I. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- J. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- K. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide glass products by Vitro Architectural Glass or a comparable product by one of the following:
 - 1. [Guardian Industries Corp.](#)
 - 2. [Pilkington North America.](#)
 - 3. [Vetrotech Saint-Gobain.](#)
 - 4. [Viracon, Inc.](#)
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.3 GLASS PRODUCTS, GENERAL

- A. Glass shall conform to ASTM C1048 and ASTM C1036, Type I, Quality-Q3, Class I – glazing select, and the following:
 - 1. Glass edges shall be clean scored and cut.
 - 2. Glass shall conform to the requirements of the Consumer Product Safety Commission's Standard 16 CFR 1201, the Safety Certification Council, ANSI Z97.1-1975, and local codes, whichever is most stringent. Notify Engineer if safety glazing is required.
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- C. Strength: 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 and calculations. 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. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- D. Low Emissivity Coated Float Glass
 - 1. Complying with ASTM C1376, coated by vacuum deposition (sputter-coating) process, and complying with other requirements specified in this Section
- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. FGIA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- F. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 - 1. Glazing in all fixed and operable panels of swinging, sliding, and bifold doors shall be considered a hazardous location and require safety glazing as per Section 2406.4.1 of the IBC 2021.
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- H. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- I. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.
- J. Glass and glazing, in combination with adjacent construction, shall provide a fully weathertight system that promptly drains all incidental water to the exterior. Glass and glazing materials shall not block weeps or otherwise impede drainage. All glazing pockets shall drain incidental water at the sill of each lite of glass; internal drainage of the glazing pockets at vertical mullions is not acceptable.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and SHGC of not less than 0.87.

1. Basis of Design: Subject to compliance with requirements, provide ultraclear glass products by Vitro Architectural Glass Starphire or a comparable product by one of the following:
 - a. [Guardian Industries Corp.](#); Ultrawhite.
 - b. [Pilkington North America](#); Optiwhite.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat treated float glass: ASTM C 1048, Type I (transparent flat glass), Quality-Q3; of class indicated, of kind and condition indicated. All heat strengthening and tempering shall be by the horizontal process, with IG units fabricated in such a manner as to have all roller distortion in a horizontal direction as installed in the building.
 1. The minimum surface and edge compression shall comply with requirements of ASTM C 1048.
 2. Requirements of ASTM C 1048 listed for 6mm HS glass shall also apply for greater thicknesses.
 3. Fully Tempered glass shall conform to ANSI Z97.1.
 4. Fully tempered glass shall be 100% heat soak tested per EN 14179-2016 in calibrated oven.
 - a. Unless otherwise specified, all fully tempered glass shall be heat soaked to minimize the occurrence of nickel sulfide (NiS) crystals. This process shall be strictly controlled and carried out to EN 14179 paying particular attention to the temperature and duration of treatment.
 - b. Records must be kept of heat soaking for each batch for QA/QC purposes and made available to the Architect on request. Such records shall include, as a minimum, the following:
 - 1) Traceability of glass, i.e. source of supply and evidence of batching.
 - 2) Dates of tempering/heat soaking.
 - 3) Certification that the glass will meet the performance requirements of this Specification.
 - 4) Records to include details of all units that failed during the heat soak test.
 - c. Responsibility for NIS Inclusions:
 - 1) Where glass is heat soak tested, the Contractor is to indemnify the Client in the event of more than 5 lite per 1000 of fully tempered glass.
 - E. Patterned Glass: ASTM C 1036, Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F2 (patterned both sides), Pattern P3 (random).
 - F. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F2 (patterned both sides), Pattern P3 (random).
 - G. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
 - H. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.
 - I. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.
 - J. Decorative Film Overlay: Translucent, dimensionally stable, polyester film, film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
 1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide 3M FASARA films, Glace finish or comparable product by one of the following:

- a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
2. Color: As selected by Architect from manufacturers full range to match color of spandrel panels.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. 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, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
 1. Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film ionoplast interlayer or cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

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. Silicone complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene 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.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

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.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; DOWSIL 795.
 - b. Pecora Corporation; 896.
 - c. Tremco Incorporated; Proglaze.
 - d. Tremco Incorporated; Tremsil 600.

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 1, for glazing applications in which tape acts as the primary sealant.
 2. 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:
1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended in writing by sealant or glass manufacturer.

- E. Edge Blocks:
 - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

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.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.
- D. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in pattern indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

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. 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.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. 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.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. 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.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. 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.
- K. 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.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. 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.

3.9 MONOLITHIC GLASS SCHEDULE

- A. Glass Type: Clear float glass.
 - 1. Thickness: 6.0 mm.
 - 2. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.
 - 3. Provide safety glazing labeling.
- B. Glass Type: Clear float glass with decorative film overlay.
 - 1. Glass Type: Clear, float glass.
 - 2. Glass Thickness: 6.0 mm.
 - 3. Use: Suitable for interior applications.
 - 4. Pattern: Match Architect's samples.
 - 5. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.

3.10 INSULATING GLASS SCHEDULE

- A. Glass Type IG-1: Low-E-coated, Ultra-clear, insulating glass, double pane thickness.
 - 1. Basis-of-Design Product: Viracon VNE1-63
 - a. Bird friendly glass 51205
 - b. 1/4" dots 2x4
 - c. Color: warm gray V952
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Outer Lite: 1/4" clear Glass
 - 4. Interspace Content: Air (5%)/Argon (95%).
 - 5. Indoor Lite: 1/4" clear Glass
 - 6. Low-E Coating: sputter on second surface.
 - 7. Winter U-Value: 0.29
 - 8. SHGC: 0.23 max
 - 9. Visible Transmittance: 51% minimum
 - 10. Certification: Must have a Minimum Avoidance Score of 79 as tested by the American Bird Conservancy.
 - 11. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.
 - 12. Provide safety glazing labeling.
- B. Glass Type: Ceramic-coated, insulating spandrel glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Outer Lite: 1/4" clear Glass
 - 3. Interspace Content: Air (5%)/Argon (95%).

4. Indoor Lite: 1/4" clear Glass
5. Coating Location: Second surface.
6. Ceramic Coating Color and Pattern: Match Architect's samples.
7. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.
8. Provide safety glazing labeling.

3.11 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type Low-E-coated, clear insulating laminated glass.
 1. Basis-of-Design Product: Viracon VNE1-63
 2. Overall Unit Thickness: 1 inch.
 3. Outdoor Lite: Clear glass:
 - a. Minimum Thickness of Indoor Lite: 6 mm.
 4. Interspace Content: Air.
 5. Indoor Lite: Clear laminated glass with two plies of annealed float glass.
 - a. Minimum Thickness of Each Glass Ply: 3 mm.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm).
 6. Low-E Coating: Second surface.
 7. Winter Nighttime U-Factor: 0.29 maximum.
 8. Visible Light Transmittance: 27 percent minimum.
 9. Solar Heat Gain Coefficient: 0.17 maximum.
 10. Glass shall be annealed, heat-strengthened or tempered as required by codes and as specified on drawings.
 11. Provide safety glazing labeling.

END OF SECTION

SECTION 08 8300

MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.
 - 2. Film-backed glass mirrors qualifying as safety glazing.
- B. Related Sections:
 - 1. Section 08 8000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
 - 2. Section 10 2800 "Toilet and Bath Accessories" for metal-framed mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, provide the following information when available:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- D. Samples: For each type of the following products:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.
- C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing, paint, film and substrates on which mirrors are installed.
- D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. 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.
- B. Glazing Publications: Comply with the following published recommendations:
 - 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- C. Safety Glazing Products: For film-backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: **Five** years from date of substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Avalon Glass and Mirror Company.
 - 2. Glasswerks LA, Inc.
 - 3. Guardian Glass; SunGuard.
 - 4. Trulite Glass & Aluminum Solutions, LLC.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
 - 1. Nominal Thickness: 6.0 mm.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

2.4 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Franklin International; Titebond Division.
 - b. Laurence, C. R. Co., Inc.
 - c. Macco Adhesives; Liquid Nails Division.
 - d. OSI Sealants, Inc.
 - e. Palmer Products Corporation.
 - f. Pecora Corporation.
 - g. Royal Adhesives & Sealants; Gunther Mirror Mastics Division.
 - h. Sommer & Maca Industries, Inc.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.5 MIRROR HARDWARE

- A. Aluminum J-Channels and Cleat: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Laurence, C. R. Co., Inc.
 - 2. Top Trim: Formed with front leg with a height matching bottom trim and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Laurence, C. R. Co., Inc.
 - 3. Finish: Clear bright anodized.
- B. Mirror Bottom Clips: As indicated.
- C. Mirror Top Clips: As indicated.
- D. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
 - 1. Profile: As indicated.
- E. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.6 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.

- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 2. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
 - 3. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 08 88 59
SPECIALTY GLASS AND GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Furnishing and installing glass panels, perimeter seals and all accessories for glass walls in water pressure conditions at exhibit pools and at exhibit view panels for animal viewing and/or underwater viewing areas.
 - 1. Ultra-Clear Float Glass Product.
 - 2. Glazing Sealants.

1.3 RELATED SECTIONS

- A. Division 03 Section "Cast-in-Place Concrete" for concrete substrate.
- B. Division 03 Section "Exhibit Rockwork" for shotcrete substrate.
- C. Division 05 Section "Metal Fabrications" for installation of glass view panels in fixed steel frames.
- D. Division 07 Section "Joint Sealants – Animal Exhibit" for specified joint sealants used in conjunction with other construction.

1.4 DEFINITIONS

- A. Exhibit Glazing: Transparent openings in public areas or keeper areas capable of supporting imposed loads of people, animals and/or hydrostatic pressure and other design loads, and act as a physical barrier. Panels shall be clear and free of visual distortions. (Also named "Glass Viewing Windows")
- B. Standard Glazing: For the purpose of this specification, standard glazing shall be all glazing that is not exhibit glazing.
- C. Oversize Laminated Glass Panes: Glass panes that exceed the dimensional requirements of Standard Size Glass Panes.
- D. Standard Size Laminated Glass Panes: Glass panes in sizes up to and including 96" x 130", the generally accepted industry standard.

1.5 SUBMITTALS

- A. Submit Shop Drawings, product data, test reports, certificates, and maintenance instructions under provisions of Division 01 Section "Submittal Procedures."
- B. Shop Drawings for fabrication and erection:
 - 1. Include plans, elevations, sections, dimensions, and typical details of mounting and attachments. Sections and details should indicate how the glazing interfaces the surrounding construction.
 - 2. Provide location and details of anchorage devices to be embedded in or fastened to other construction.
 - 3. Furnish templates if required for accurate placement.
- C. Product Data: Provide manufacturer's data on all products proposed for use. Manufacturer's data should include product material, characteristics, physical properties and installation instructions.
- D. Compatibility: Submit data from sealant and coatings manufacturer indicating sealants and coatings are compatible with the substrates to which they are bonded and to other materials they may contact.
 - 1. Sealant Substrate Testing: Have manufacturer of sealant test glazing materials, glass and substrates for proper adhesion and compatibility. Allow adequate time and coordination for testing to prevent delay of work.
 - 2. Submit sealant manufacturer's report on testing and recommendations for use of sealants and preparation of substrates.
- E. Certificates: Submit manufacturer's certification that products meet or exceed specified requirements.
- F. Maintenance Data: Submit material suitable for inclusion in manuals specified in the General and supplementary conditions. Include maintenance instructions, purchase source listing, and similar information
- G. Warranty: Submit four (4) notarized copies of each of the written warranties identified in this section, and distribute as follows:
 - 1. 3 copies to the Owner.
 - 2. 1 copy to the Architect.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Materials used for the installation of exhibit glass system, including glazing, and sealant installation, shall be under the sole direction of the Exhibit Glass sub-contractor, who shall warrant all work to the requirements specified below. If any items are installed separately, not directly under the control of the Exhibit Glass sub-contractor responsible for the warranty, then the Exhibit Glass sub-contractor shall submit written acceptance to the Construction Manager and Owner of any and all work prior to installation. Exhibit Glass subcontractor shall provide written acceptance of frame and support assembly. If any work is not to the satisfaction of the Exhibit Glass sub-contractor, then this work shall be corrected before glazing installation.
- B. Manufacturer Qualifications: Products specified must be primary product of manufacturer. Manufacturer must have minimum five years documented experience in similar work specified under this section.

- C. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.
- D. Installer Qualifications: Installer must be acceptable to or licensed by manufacturer of product being installed. Installer must have minimum five years documented experience in similar work specified under this section.
- E. Physical Properties: Provide products that comply with the requirements of this Section.

1.7 PRE-INSTALLATION CONFERENCE

- A. Prior to the installation of work of this section, conduct a meeting at the project site to discuss quality assurance requirements, review installation procedures and time schedule proposed for glazing and coordination with other work. In addition to the contractor and the installer, arrange for attendance of the following:
 - 1. Sub-contractors affected by the work.
 - 2. Owner's representative.
 - 3. Architect.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Pack and otherwise protect each unit to avoid marring or otherwise damaging products during shipping and handling.
- B. Delivery and Storage: Deliver materials to site in compliance with construction scheduling. Provide care to maintain protective coverings, and to avoid exposures to abrasive substrates, condensation, moisture, direct exposure to the sun, excessive heat and other sources of possible deterioration. Complete installation and concealment as rapidly as possible in each area of work.

1.9 FIELD CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes. Install glazing sealants only when temperatures are in the middle third of manufacturer's recommended installation temperature range and all materials and substrates are at equal temperature.
- B. Install liquid sealants at ambient and substrate temperatures in optimal temperature range according to sealant manufacturer information.

1.10 SPECIFIED PRODUCT WARRANTY

- A. Installer agrees to repair or replace components that fail(s) in materials or workmanship within a specified warranty period.
- B. The Warranties identified herein shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

- C. Manufacturer Warranties: The manufacturer shall submit the following written warranties:
1. Laminated glass warranty: Warranty shall state that the glass conforms with drawings and specifications as may be amended by the Architect, meets all minimum provisions as detailed by the GANA Protective Glazing Manual and ASTM C 1172, and to the proportion specified, be free of bubbles, unbounded areas, blushing of the interlayer and other imperfections for a minimum period of 5 years after installation. The warranty shall be submitted by the glass manufacturer and installer with a provision that replacements of defective glass will be made at no cost to the Owner.
 - a. Defective glass includes, but is not limited to: structural failure, delamination, observable defects in excess of ASTM standards, edge abrasions, etc.
 2. Sealants warranty: With the exception of Dow Corning's 795 sealant at underwater conditions, warranty shall state that the sealants conform with drawings and specifications as may be amended by the Architect, be compatible with substrates and other materials which it contacts and not exhibit any adhesive or cohesive failure or other deterioration for a period of 10 years. The warranty shall be submitted by the sealant manufacturer and the glazier with a provision that replacements will be made at no cost to the Owner.
- D. Installer Warranty: The exhibit glass installer shall warrant his work comprising of the total assemblies that make up glass viewing windows, for defective materials, workmanship, and installation. Defective materials and workmanship is hereby defined to include, but not be limited to showing evidence of:
1. Penetration of water into the observation area.
 2. Adhesive or cohesive failure to sealant.
 3. Crazing on surface of sealant.
 4. Hardening of sealant beyond Shore A durometer 50 or softening below 20.
 5. Failure to fulfill other specified performance requirements.
- E. The warranty, the enforcement or lack of enforcement thereof, shall not deprive the Owner of other actions, rights, or remedies available to him. Warranty shall be approved by the Owner. Contractor shall include with his bid a copy of proposed warranty.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The base glass shall be Quality q3 float glass as defined in and conforming to ASTM Standard C 1036 proportional to the thickness of the glass.
- B. Fully Tempered glass shall comply with all provisions of ASTM Standard C 1048 except as may be modified by the Architect. All fully tempered glass shall be heat soak tested after tempering of the glass in accordance with EN 14178-1.
- C. Laminated glass shall comply with all provisions of ASTM Standard C 1172 except as may be modified by the Architect.
1. Viewing windows for animal enclosures and pools shall be the number of plies of laminated glass (see schedule) with a minimum 0.060" pvb interlayer, unless noted otherwise. All plies shall be the same thickness except as may be approved by the Architect.
 2. Exterior Site viewing windows where panel edges are exposed to the elements shall be laminated glass with a minimum 0.060" SentryGlas ionoplast interlayer. All other qualifications to be the same as "1".

3. Glass panels to be fabricated and installed with roller wave parallel to grade in locations where glass panel width is 8 feet or less.

2.2 MANUFACTURERS/FABRICATORS

- A. Glass Panes: Provide glass panes complying with the requirements of the Contract Documents and supplied by one the of the following:
1. Agnora, 200 Mountain Rd., Collingwood, Ontari Canada, L9Y 4V5. Phone: (705) 444-6654.
 2. Rochester Insulated Glass, Inc., 73 Merrick Circle, P.O. Box 168, Manchester, NY 14504. Phone: (800) 732-0400.
 3. Arnold Glas Corp., 48 Spinney Path, Nahant, MA 01908. Phone: (857) 294-7768.
 4. McGrory Glass Inc., 1400 Grandview Avenue, Paulsboro, NJ 08066. Phone: (800) 220-3749.
 5. Viracon, Inc., 800 Park Drive Owatonna, MN 55060. Phone: (800) 533-0482.
 6. Empirehouse, Inc., 5200 Quincy Street, Mounds View, MN 55112. Phone: (763) 535-1150.
 7. Saint-Gobain Glass, 15825 N. 71st Street, Suite 205, Scottsdale, AZ 85254. Phone: (480) 607-9400.
 8. GlasPro, Inc., 9401 Ann Street, Santa Fe Springs, CA 90670-2613. Phone: (800) 776-2368.
 9. Oldcastle Building Envelope, 291 M. Street, Perrysburg, OH 43551. Phone: (419) 666-2000.
 10. JE Berkowitz, L.P. One Gateway Blvd., P.O. Box 427, Pedricktown, NJ 08067. Phone: (800) 257-7827.
 11. US Armor, LLC, P.O. Box 400, Lenoxdale, MA 01242. Phone: (800) 450-3873.
 12. Standard Bent Glass, P.O. Box 469, Butler, PA 16003. Phone: (800) 634-9252.
 13. PRL Glass Inc., 13644 Nelson Ave., City of Industry, CA 91746. Phone: (800) 433-7044.
 14. Bent Glass Design, 3535 Davisville Road, Hatboro, PA 19040. Phone: (215) 441-9101.
 15. Nashville Tempered Glass, 1860 Air Lane Dr., Nashville, TN 37210 (615) 889-6350.
 16. Glasswerks, 8600 Rheem Avenue, South Gate, CA 90280 (888) 789-7810.
 17. Cristacurva, 13105 Northwest Freeway, Suite 800, Houston, TX 77040 (866) 827-6049.
 18. Any other glass fabricator, subject to all technical standards and requirements as specified herein, and with prior written approval of the Architect.

2.3 MATERIALS

- A. Base glass type: Commercial grade clear soda-lime float glass, Type 1, Low Iron.: Blemishes shall not exceed those allowed in ASTM Standard C 1036, Table 3, for Quality q3 glass.
- B. Fully Tempered glass: Processing blemishes shall not exceed those cited in ASTM Standard C 1048 with the following amendments:
1. The bow and warp shall not exceed 50 percent of the values listed in table 2.
 2. For laminations with more than two glass plies the allowable blemishes listed Table 3 shall be increased in number, but not intensity, by a factor equal to the number of glass plies divided by two.
 3. Asymmetrical laminations shall not be allowed unless approved in writing by the Architect.

2.4 ADDITIONAL MATERIALS – EXHIBIT GLAZING

- A. Spacers: Silicone; shore, ASTM C 854 durometer 70+/-5" hardness; must be compatible with silicone per manufacturer's recommendations.
- B. Polyurethane sealants, surface primers and epoxy protective coatings as manufactured by Sika Corporation USA.
- C. Continuous Face Gaskets: Silicone; shore A durometer 70+/-5".
- D. Setting Blocks: Silicone of 80 to 90 Durometer hardness or as specifically recommended by the glass manufacturer for the particular type of glass units to be installed. The height of the blocks shall be a minimum of 1/4 inch and the minimum depth equal to the glass thickness plus 1/8 inch. The length (in) of each block to be 0.1 x Area (ft²), two setting blocks per panel.
- E. Sealant Backer Rod: Where sealant is applied without a back-up gasket or other material, closed cell ethafoam backer rod shall be installed.
- F. Glazing Tape: Polyisobutylene base specifically recommended by the glass manufacturer for the particular type glass units to be installed.
- G. Anti-reflective Coating: Guardian Clarity Neutral. In locations and on panel surfaces indicated on drawings.

2.5 SEALANTS

- A. Perimeter Sealant: Dow Corning 795 Silicone Sealant, in colors as selected from manufacturer's full range.
- B. Butt Joint Sealant: Provide one of the following:
 - 1. Dow Corning 995 Silicone Structural Adhesive
 - 2. GE Silicones 'Ultraglaze SSG4000 Silicone Structural Glazing Sealant'

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer shall inspect concrete and steel framing and other framing materials to determine that they are satisfactory. A satisfactory surface is defined as one that conforms to the configuration, dimensions and tolerances as indicated in the contract documents.
- B. Examine openings to receive tempered/laminated glass glazing panels and verify the following:
 - 1. Application of epoxy primer where specified for panel recess not less than 3 days prior to glazing and that application is flat, smooth and free of cracks and pinholes.
 - 2. Size of openings are within tolerances specified.
 - 3. That concrete and steel surfaces are smooth, free from cracks, holes, protrusions, coatings or other unsatisfactory conditions that can impair performance.

- C. Perform bond and moisture tests on concrete substrates to determine that concrete is sufficiently cured and dry or if curing compounds are present.
- D. Provide written report listing conditions detrimental to performance of glazing work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with installation will imply acceptance of the substrate by the window installer.

3.2 PREPARATION

- A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer for optimum installed performance.
- B. Prime substrate in accordance with recommendations of manufacturer for optimum installed performance.
- C. Mask off or otherwise protect adjacent surfaces not scheduled to receive products of this section.

3.3 INSTALLATION

- A. General: Provide a complete and fully supervised panel installation. Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
- B. The substrate opening dimensions indicated on Drawings are designed to provide the necessary bite on glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust glazing lites during installation to ensure that bite is equal on all sides unless noted otherwise in the contract documents.
- C. Apply bearing pads and set panels into openings in accordance with glass panel manufacturer's recommended procedure.
- D. Provide edge blocking to comply with requirements of specifications, except where otherwise required by glass panel manufacturer.
- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass panel manufacturers, to prevent sealant from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- G. Mix and apply sealants. Comply with combined printed recommendations of manufacturers of glazing and of sealants, and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glazing and channel surfaces. Tool exposed surfaces of sealants to provide a substantial "wash" way from glazing.

- H. Tolerances: Install products of this section to within the tolerances stated above.
- I. Protect glass from edge damage during handling and installation. Do not install glass with edge damage or defect.

3.4 CLEANING AND POLISHING

- A. During progress of the work, remove from project site all discarded materials, rubbish and debris resulting from the work.
- B. Upon completion, clean all surfaces that have become soiled or coated as a result of work of this section, using proper methods that will not scratch or otherwise damage finished surfaces.
- C. For cleaning and polishing, use only products and techniques acceptable to manufacturer of products being cleaned.
- D. Remove protective coverings and clean and polish installed panels in accordance with the manufacturer's printed instructions.
- E. Tolerances: Install products of this section to within the tolerances as stated above.

3.5 PROTECTION

- A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at date installation completion. Provide 1/4" masonite or other approved puncture-proof temporary protection on both sides of glazing which can be removed and replaced multiple times without damage.

3.6 GLASS SCHEDULE

- A. See drawings.

END OF SECTION 08 88 59

SECTION 08 9119

FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 550.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with General Emissions evaluation.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- D. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 550 by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 550.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- E. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- F. Low-emitting requirements – Interior Products
 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- G. Additional Low-emitting requirements – Adhesives and Sealants:
 1. Do not use adhesives that contain urea formaldehyde.
 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- H. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Stationary Blade Louver:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide ELF 6375DX by Ruskin Company or comparable product by one of the following:
 - a. Airolite Company, LLC (The).
 - b. American Warming and Ventilating, Inc.; a Mestak company.
 - c. Construction Specialties, Inc.
 - d. Industrial Louvers, Inc.
 - e. Reliable Products, Inc.
- B. Fabrication:
 1. Design: Stationary drainable louver type with drain gutters in each blade and head with downspouts in jambs and mullions with all welded construction. Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm). Steeply angled integral sill.
 2. Frame:
 - a. Frame Depth: 6 inches (152 mm).
 - b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
 - c. Material: Extruded aluminum, Alloy 6063-T6.
 3. Blades:
 - a. Style: Drainable. 37.5 degrees at 5-29/32 inches (150 mm), nominal.

- b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
 - c. Material: Extruded aluminum, Alloy 6063-T6.
- 4. Minimum Assembly Size: 12 inches wide by 12 inches high (305 mm x 305 mm).
- 5. Maximum Factory Assembly Size: Single sections shall not exceed 120 inches wide by 90 inches high (3048 mm x 2286 mm) or 90 inches wide by 120 inches high (2286 mm x 3048). Louvers larger than the maximum single size shall be require field assembly of smaller sections.
- C. Performance Data:
 - 1. Based on testing 48 inch x 48 inch (1,219 mm x 1,219 mm) size unit in accordance with AMCA 500.
 - 2. Free Area: 57 percent, nominal.
 - 3. Free Area Size: 9.08 square feet (0.84 m²).
 - 4. Maximum Recommended Air Flow through Free Area: 1023 feet per minute (5.2 m/s).
 - 5. Air Flow: 9289 cubic feet per minute (263 m³/s).
 - 6. Maximum Pressure Drop (Intake): 0.15 inches w.g. (0.035 kPa).
 - 7. Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m²) of free area at an air flow of 1,023 feet per minute (5.2 m/s) free area velocity when tested for 15 minutes.
 - 8. Louvers shall be factory engineered to withstand the specified seismic loads.
 - a. Minimum design loads shall be calculated to comply with ASCE – 7, or local requirements of Authority Having Jurisdiction (AHJ).

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening except where insect screening is indicated.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Mill finish unless otherwise indicated.
 - 3. Type: Non-rewirable, U-shaped frames.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - 1. Thickness: 2 inches.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Metal Facing Sheets: Galvanized-steel sheet, not less than 0.028-inch nominal thickness.
 - 4. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
 - 5. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, with corners mitered and with same finish as panels.
 - 6. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 - 7. Panel Finish: Same finish applied to louvers.
 - 8. Attach blank-off panels with clips.

2.6 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- C. Include supports, anchorages, and accessories required for complete assembly.
- D. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
- E. Provide subsills made of same material as louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. 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.
2. Louvers to match adjacent surfaces – assume 5 colors total.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, 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 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 0130

PLASTER PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Repair and replacement of interior and exterior lime plaster.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 SEQUENCING AND SCHEDULING

- A. Perform treatment of plaster in the following sequence, which includes work specified in this and other Sections:
 - 1. Dismantle existing surface-mounted objects and hardware that overlie plaster surfaces except items indicated to remain in place.
 - 2. Verify that temporary protections have been installed.
 - 3. Examine condition of plaster surfaces.
 - 4. Clean plaster surface and remove paint and other finishes to the extent required.
 - 5. Repair and replace existing plaster and supports to the degree required for a uniform, tightly adhered surface on which to paint or apply other finishes.
 - 6. Cure repaired surfaces and allow them to dry for proper finishing.
 - 7. Paint and apply other finishes.
 - 8. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For each configuration of new or replicated plaster molding and ornament required for the work.
 - 1. Include plans, elevations, and sections that show locations and extent of work.
 - 2. Show full-size details of configurations, joint locations, and attachments to other work.

- D. Samples for Initial Selection: For each exposed product that will be exposed and not be painted or otherwise finished and for each color and texture specified.
- E. Samples for Verification: For the following products:
 - 1. Metal Lath: 18 inch square.
 - 2. Accessories: Each type in manufacturer's standard size.

1.6 QUALITY ASSURANCE

- A. Plasterwork Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for treatment work and protection of surrounding materials and Project site.
 - 1. Include methods and procedures to protect plastered surfaces from damage caused by construction operations, including, but not limited to, exposure to moisture, vibration, mechanical damage, and soiling.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for each substrate and finish texture indicated for plastering, including accessories.
 - a. Size: 100 sq. ft. in surface area.
 - b. 12"x12" of each selected color.
 - 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 packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store materials on elevated platforms, under cover, and in a dry location with ambient temperatures continuously maintained at not less than 45 deg F.
- C. Store hydrated lime and factory-prepared lime putty in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store materials not in use in tightly covered containers.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.8 FIELD CONDITIONS

- A. Comply with plaster-material manufacturers' written instructions.
- B. Temperatures: Maintain temperatures in work areas at not less than 55 deg F for greater than 80 deg F for at least seven days before application of plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.

- C. Avoid conditions that result in plaster drying out too quickly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - 2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
 - 3. Ventilate work areas in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Environmental product Declarations:
 - 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 LIME-PLASTER MATERIALS

- A. Hydrated Lime: ASTM C206, Type S or Type N.
- B. Lime Putty: Slaked hydrated lime or factory-prepared lime putty according to ASTM C1489.
- C. Sand Aggregates: ASTM C897.
 - 1. Finish-Coat Sand: Match size, texture, and gradation of existing sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- D. Pigments for Colored Plaster: ASTM C979/C979M and having a record of satisfactory performance in lime plaster.
- E. Fiber: 1/2 to 1 inch in length; composed of natural linen, cotton, hemp, or jute fiber or alkali-resistant glass or polypropylene fiber; free of grease, waxes, and oils; and beaten well to separate fibers before blending into unfibered plaster material.
 - 1. Proportion of Fiber to Unfibered Plaster Material: 3.5 oz./cu. ft. of unfibered plaster material, adjusted as required to produce a well-fibered, cohesive, spreadable, stiff mix with fibers uniformly distributed.

2.3 LATH

- A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich Building Systems.
 - c. MarinoWARE.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 3. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd..
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.
1. Provide paper-backed lath in locations indicated on Drawings.

2.4 ACCESSORIES

- A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO.
 - b. ClarkDietrich Building Systems.
 - c. Fry Reglet
 - d. MarinoWARE.
 2. Foundation Weep Screenshot: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
 3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
 4. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
 5. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
 6. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 7. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 8. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 9. Misc. trim as detailed.

2.5 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fasteners for Attaching Metal Lath to Substrates: ASTM C 841.
 1. For Lime Plaster: ASTM C1063.
- C. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.
- D. Plaster-Stabilization Materials: Acrylic emulsion(s) and related installation products shall have proven effectiveness in reattaching delaminated plaster.

1. Acrylic Emulsion(s), General: Aqueous emulsion(s) of acrylic polymer, adhesive to plaster and plaster substrates, nontoxic, and non-reemulsifiable after curing.
 2. Prewet Solution: Low-viscosity acrylic emulsion.
 3. Adhesive: Thickened acrylic emulsion; thickener as recommended in writing by resin manufacturer.
- E. 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 condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave an unintended residue on surfaces.

PART 3 - EXECUTION

3.1 TREATMENT OF PLASTER, GENERAL

- A. Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from building interior at 5 feet away from surface.
- B. General: In treating plaster, disturb it as minimally as possible and as follows unless otherwise indicated:
1. Dismantle loose, damaged, or deteriorated plaster, lath, and support systems that cannot be repaired.
 2. Verify extent of plaster deterioration against that indicated on Drawings. Consult Architect on types and extent of required work.
 3. Verify that substrate surface conditions are suitable for repairs.
 4. Provide lath, furring, and support systems for plaster included in the work of this Section.
 5. Replace lost details in new, wet-applied that replicate existing or indicated plaster configurations.
 6. Leave repaired plasterwork in proper condition for painting or applying other finishes as indicated.
 7. Install temporary protective measures to protect surfaces that shall be treated later.
- C. Illumination: Perform plastering work with adequate, uniform illumination that does not distort the flatness or curvature of surfaces.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate and environmental conditions, installation tolerances, and other conditions affecting performance of the Work.
1. If existing substrates cannot be prepared to an acceptable condition for plastering work, notify Architect in writing.
 2. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- B. Masonry Substrates: Verify that mortar joints are struck flush. Notify Architect of undocumented masonry substrate without flush joints. Proceed with plastering as directed by Architect.
- C. Begin plastering work only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Substrates: Prepare according to plaster manufacturer's written instructions and as follows:
 - 1. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with plaster.
 - 2. Remove ridges and protrusions greater than 1/8 inch and fill depressions greater than 1/4 inch with patching material. Allow to set and dry.

3.4 PLASTER REMOVAL AND REPLACEMENT, GENERAL

- A. Dismantle plaster that is damaged or deteriorated to the limits indicated. Carefully dismantle areas along straight edges that lie over supports, without damaging surrounding plasterwork.
- B. Maintain lath and supporting members in an undamaged condition so far as practicable. Dismantle damaged lath and supports that cannot be repaired or resecured and replace with new work of same type.
- C. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- D. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
- E. Clean substrate surfaces to remove grease, waxes, oils, waterborne staining, debris, and other foreign matter and deposits that could impair bond with repair material.
- F. Wet masonry bases before plaster application. Keep substrate damp to the touch but without visible water droplets.
- G. Wet remaining plaster abutting the replacement plaster before installing new plasterwork.
- H. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
- I. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

3.5 FLAT LIME-PLASTER REMOVAL AND REPLACEMENT

- A. General: Dismantle deteriorated plaster to existing sound plaster at locations indicated on Drawings.
 - 1. Inspect for lath deterioration. If any, replace lath.
 - 2. Sand bonding surfaces of repair area, and clean the surface with a nonmetallic bristle brush.
 - 3. Wet substrate to damp condition, but without visible water droplets, then install new plaster to original profiles.
- B. Lime-Plaster Base Coats:
 - 1. Scratch Coat: 1 part lime putty, 2-1/2 parts base-coat sand, and fiber.
 - 2. Brown Coat: 1 part lime putty, 3 parts base-coat sand.
- C. Lime-Plaster Finish Coats:

1. Finish-Coat Mix: As required to match finish of design reference sample.

- D. Hairline cracking within the plaster or plaster separation at edge of a replacement is unacceptable. Completely dismantle such work and reinstall or repair as a crack repair.

3.6 REMOVING AND INSTALLING LATH AND ACCESSORIES

- A. General: Dismantle existing plaster as necessary to expose deteriorated or rusted lath, wire ties, and support system, back to firm substrates and supports. Repair with new materials, well secured to existing lath in good condition and to building structure.
 1. Cutting: Cut lath so it can be taken out completely from one support to the next. Cut to avoid cracking surrounding plaster.
 2. Cut out existing base-coat plaster beyond the edges of the new lath to permit new plaster to extend onto the old lath. Then step subsequent plaster coats to permit new plaster to extend over the old material.
 3. Fasten new lath to support system and to good existing lath. Wire tie at least every 6 inches.
 4. Install new lath according to ASTM C1063 for lime plaster.
- B. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- C. Metal Lath: Install according to ASTM C 841 for plaster.

3.7 PATCH-TYPE REPAIR

- A. General: Patch voids, fractured surfaces, and crushed areas in otherwise sound plaster that are larger than cracks.
 1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
 2. Inspect for deterioration of supporting plaster and lath, and repair or replace deteriorated material as required for a sound substrate.
 3. Rake perimeter of hole to sound plaster, and slightly undercut existing plaster to enable replacement plaster to tuck behind existing plaster.
 4. Replace missing lath in kind. Bridge gaps in wood lath with expanded-metal lath, overlapping wood by 6 inches and fastening them together.
 5. Clean hole to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the plaster, enlarge the hole to remove these deposits.
 6. Wet substrate to damp condition, but without visible water droplets, then install patch material to original profiles.
 7. Maintain adjacent plasterwork in an undamaged condition so far as practicable.
- B. Lime-Plaster Mix: 1 part lime putty, 2-1/2 parts sand, applied in two coats with fiber in first coat. Repair mix demonstrated in mockup.
- C. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.
- D. Hairline cracking within the plaster or plaster separation at edge of a patch is unacceptable. Completely dismantle such work and reinstall or repair.

3.8 HAIRLINE CRACK REPAIR

- A. General: Repair cracks 1/32 inch in width or narrower in otherwise sound plaster.
 - 1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
 - 2. Maintain adjacent plasterwork in an undamaged condition so far as practicable.
- B. Existing Topcoat: Open crack in existing topcoat to at least 1/8 inch in width and check for broken fiber reinforcement in base coats.
- C. Existing Base Coats: Do not open crack wider in existing base coats unless inspection or other indication shows that the fiber reinforcement has broken. Where inspections indicate failure of fiber reinforcement, proceed as for a large crack repair, but only for length of crack with broken fiber reinforcement.
- D. Clean out crack to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the topcoat plaster, widen the crack and sand surface of the exposed basecoat to remove these deposits.
- E. Wet substrate to damp condition, but without visible water droplets.
- F. Force finish-coat plaster without aggregate into crack, filling crack to original plaster profile.
- G. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.

3.9 LARGE CRACK REPAIR

- A. General: Repair cracks over 1/32 inch in width in otherwise sound plaster.
 - 1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
 - 2. Maintain adjacent plasterwork in an undamaged condition so far as practicable.
- B. Open crack to at least 1/8 inch in width and full depth with V-groove tool, and check for bond separation or lath deterioration.
- C. Abrade side surfaces of crack and remove inner crack debris by gouging (keying) the inside area of the crack.
- D. Clean out crack to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the plaster, widen the crack to remove these deposits.
- E. Wet substrate to damp condition, but without visible water droplets.
- F. Install finish-coat plaster to fill crack to original plaster profile.
- G. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster. For molded plaster shapes, tool surface to restore the sharp edges and the shape of the molded shape to original contours.

- H. Offset Cracks: If the crack is offset in surface plane by more than 1/8 inch, dismantle the plaster on each side of the crack, a minimum width of 6 inches and down to the lath or other substrate. Then, repair as specified for flat-plaster removal and replacement.

3.10 REATTACHMENT OF DELAMINATED PLASTER

- A. General: Reattach plaster that has detached from its lath.
 - 1. Notify Architect of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
 - 2. Maintain adjacent plasterwork in an undamaged condition so far as practicable.
- B. Verify extent of detachment of plaster that has not yet fallen by tapping on plaster surface and evaluating the hollow or solid resonance.
- C. Protect floors from spillage and debris in the vicinity of work. Use materials resistant to the passage of fluids used in work.
- D. Drill 1/4-inch injection ports (holes) through the plaster spaced 3 to 6 inches apart over surface of detached plaster. Dislodge loose plaster particles, and vacuum debris from holes.
- E. Prewet injection ports, gaps at edges of lost plaster, back of plaster, and wooden lath with prewet solution.
- F. Inject adhesive into ports, enough to fill gaps between detached plaster and lath, and inject into gaps at edges of lost plaster.
- G. Clean off excess and smeared adhesive while wet.
- H. Apply temporary battens over surface of treated plaster to prevent further separation during repair work. Secure battens in place against plaster with braces supported from floor below.
- I. Maintain temporary battens in place for a week or more, allowing adhesive to coalesce and dry.
- J. Remove battens, patch holes and missing plaster, and repair cracks.

3.11 INSTALLATION TOLERANCES

- A. Completed plaster installation shall not deviate from a true plane by more than 1/8 inch as measured by a 5-foot straightedge placed at any location on a surface, except where existing plaster is retained as a substrate for new plasterwork.

3.12 CLEANING AND PROTECTION

- A. Protect work of other trades against damage. Promptly remove plaster from surfaces not indicated to be repaired or plastered. Do not scratch or damage finished surfaces.
- B. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.
- C. Correct damage to other surfaces and to new work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. Remove temporary protection and enclosure of other work.

END OF SECTION

SECTION 09 0561

MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.
 - 1. Apply moisture-vapor-emission-control systems to floor slabs where floor coverings are indicated, if necessary to prepare concrete substrates so moisture-vapor emissions are within acceptable levels according to floor covering manufacturers' requirements.

1.3 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Experience: Installer's personnel with experience in the successful performance of Work similar to scope of this Project.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has experience installing products and systems similar to scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Prepare and test concrete according to vapor control coating and floor covering manufacturers' written instructions.
- 1.6 FIELD CONDITIONS
- A. Ambient Conditions: Install within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance.
- 1.7 COORDINATION
- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- 1.8 WARRANTY
- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
1. Defects include, but are not limited to, the following:
 - a. Structural failures including delamination or blistering.
 - b. Incompatibility with or failure of product to adhere to substrate material up to the tensile strength of concrete.
 2. Replacement includes removal of existing flooring and underlayment or moisture vapor reducing membrane, replacement of defective or non-performing material, and replacement of finish flooring with new flooring of the same type.
 3. Period of warranty: 10 years.

PART 2 - PRODUCTS

2.1 MOISTURE BARRIER FLOOR TREATMENT

- A. Moisture Vapor-Emission Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy- resin, membrane-forming system; recommended by floor covering manufacturer to prevent adhesion problems of installed flooring caused by excess alkalinity and moisture occurring in concrete slabs.
1. Basis-of-Design Product: Koester American Corporation, (www.koesterusa.com); VAP 1 2000.
- B. Accessories:
1. Patching and leveling material.
 2. Crack-filling material.
 3. Cementitious Underlayment: If required to maintain manufacturer's warranty, hydraulic cement based.

2.2 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi compressive strength after 28 days when tested according to ASTM C 109/C 109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's hydraulic cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.3 PRE-INSTALLATION TESTING

- A. Moisture Testing: Prior to installation of floor treatment, perform one or both of the following tests as recommended by floor treatment manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive floor treatment and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof.
 - 1. Anhydrous Calcium Chloride Test: Perform test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
 - 2. Relative Humidity Test: Perform test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.
- B. Alkalinity and Adhesion Testing: Perform tests recommended by floor treatment manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydryon paper is applied.
- C. Test Results: Use test results to determine required coverage rates, dry film thickness (DFT), and number of coats (one or two) necessary for installation per floor treatment manufacturer's installation instructions.
 - 1. Freshly Placed ("Green") Concrete: If installing product over freshly placed ("green") concrete, conduct moisture testing after initial floor treatment installation to determine further coverage rates, dry film thickness (DFT), and number of coats (1 or 2) necessary for installation per floor treatment manufacturer's installation instructions

3.4 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.5 POST-INSTALLATION TESTING

- A. Post-Installation Moisture Testing and Alkalinity and Adhesion Testing: Perform testing as specified in relevant Division 09 flooring Sections.
- B. Failure of Post-Installation Moisture Testing and Alkalinity and Adhesion Testing: Post-installation testing that does not meet finish flooring manufacturers requirements will be remediated by floor treatment manufacturer under this Section at no additional cost to the Owner.

3.6 PROTECTION

- A. Procedures: Protect from damage during installation and remainder of construction period, according to manufacturer's written instructions.

3.7 SCHEDULE

- A. Locations: Apply to ground floor, non-tiled areas and where indicated on drawings.
- B. Impervious Floorings (Ground Floor or above): Refer to various Division 09 impervious flooring Sections for reactive use of this product if results of impervious flooring moisture testing are negative.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
- B. Related Requirements:
 - 1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope and demonstrates product complies with required Global Warming Potential Baseline.
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Delegated-Design Submittal: For non-structural metal framing.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed steel studs and tracks, firestop tracks, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design non-structural metal framing.
- B. 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.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft..
- E. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- F. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.
- G. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- H. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- I. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 - 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is at least equal to the Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines dated 2019.11.16 as found on EC3 and as listed below for reference:

2. Embodied Carbon (GWP) Baselines: Steel
 - a. Light-gauge metal framing – 3.0 kg CO₂eq per kg/ 1.4 kg CO₂eq per lb.
3. System Boundary: Product Stage A1-A3.
4. Declared Units: 1 kilogram or 1 pound.
5. Product Category Rules:
 - a. Institut Bauen und Umwelt e.V. PCR for Thin walled profiles and profiled panels of metal, v.1.0/1.7/1.0, 2019-01-08
 - b. International EPD System PCR for Basic iron or steel products & special steels, except construction products, v.2.0, 2020-03-27.
 - c. UL Environment PCR for Designated Steel Construction Products, v.2.0, 2020-12-31.
6. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

2.2 FRAMING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. CEMCO; California Expanded Metal Products Co.
 2. ClarkDietrich Building Systems
 3. MarinoWARE.
 4. MBA Building Supplies
 5. SCAFCO Steel Stud Company.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Framing Members, General: Comply with AISI S220 and ASTM C645, for conditions indicated.
 1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, requirements for metal unless otherwise indicated
 2. Protective Coating: Comply with ASTM C645; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- D. Studs and Runners: AISI S220 and ASTM C645. Use either steel studs and runners or embossed steel studs and runners.
 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
 - b. Depth: As indicated on Drawings.
 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: As required by performance requirements for horizontal deflection.
 - b. Depth: As indicated on Drawings.
- E. Slip-Type Head Joints: Where indicated, provide the following:
 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch minimum vertical movement.
 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

3. Double-Track System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 4. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of 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.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.033 inch.
- H. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Depth: As indicated on Drawings.
- J. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- K. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
1. Post-Installed 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.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

- d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated:
Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, in size indicated on Drawings.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.
 3. Embossed Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0190 inch.
 - b. Depth: As indicated on Drawings.
 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Chicago Metallic Corporation.
 - c. United States Gypsum Company.

2.4 ISOLATORS

- A. Resilient Sway Bracing:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mason Industries types "DNSB" and "WIC" (714-630-0701),
 - b. Kinetics Noise Control types "PSB" and "Unibrace" (614-889-0480)
- B. Isolators for Resilient Ceilings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heavy Duty
 - 1) Mason Industries "30N"
 - 2) Kinetics Noise Control "Gotham." (ICC)
 - b. Light Duty:
 - 1) Mason Industries "WHR"
 - 2) Kinetics "AF".
- C. Neoprene Partition Supports:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mason Industries "NPS."
- D. Damping compound: Provide visco-elastic vibration damping compound in liquid form for spray application. Damping compound shall be non-toxic, non-flammable, water-based emulsion suitable for covering metal surfaces.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Soundcoat Company GP-1, Irvine, CA (949-955-9202)
 - b. Blachford, Inc. Aquaplas DL-10, Chicago, IL (630-231-8300)
 - c. Kinetics Noise Control KDC-E-162, Dublin, OH (614-889-0480)
 - d. Silent Running SR500 (203-469-1337)
 - e. Pyrotek Noise Control Sound Paint SP150 (509-991-8548).
- E. Steel Deck Insert: One piece fire retardant plug for steel deck flutes:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. J-M "Deck Plug Fire Stop".
- F. Partition Isolation Pad and Anchor Isolator:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Model Wallmat
 - 1) Model Wallmat is 1/2-inch (13-mm) thick and designed to carry continuous loads up to 25-psi (17-N/cm²) without excessive creep or pad failure.
- G. Sound Isolation Clips:
 1. Sound isolation clips specified shall be designed and manufactured by Kinetics Noise Control, Dublin, Ohio. Product shall be Model Iso-Max Sound Isolation Clips.
 2. Vertical Load capacity. Clips shall have sufficient capacity to support wall or ceiling weights as constructed. In a vertical load test comparable to a ceiling installation, the clip shall have a minimum design load capacity of 36 lbs. using 25 gauge furring channel. The minimum design load capacity when using 22 gauge furring channel shall be 48 lbs. Design Load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum Design Load. Anchors for attachment of the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.
 3. The isolation clips shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8 in. x minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
 4. The isolation clip is attached to the wall/ceiling framing or other structural substrate through galvanized steel brackets on each side of the rubber isolation element. The brackets shall be of sufficient strength to carry the wall or ceiling weight without bending or failure.
- H. Provide engineering and inspection services for all resilient ceiling and wall isolator installations. An engineer retained by the manufacturer is responsible to provide detailed design of isolator installations in compliance with loading criteria defined by the project's structural engineer. Submit spacing of isolators for each wall and ceiling condition.
- I. Furnish and install ceiling and wall isolators at all rooms having concrete floating floors and where indicated.
- J. Size isolators to comply with load and deflection requirements.

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 thick, in width to suit steel stud size.

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.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended 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.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 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. 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.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. 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 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 o.c.

- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 24 inches o.c.
- 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.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. 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.
 - 4. 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.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. 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.
- 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.

- G. Isolation clips: Spacing and location of sound isolation clips shall be determined by the manufacturer based on wall or ceiling type. Installation drawing details shall be provided by the manufacturer to assure optimum sound control and structural integrity of the system.
- H. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 2400

CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior portland cement plasterwork (stucco) on various substrates:
 - a. 3 coat system on metal lath
 - b. 2 coat system on unit masonry and/or monolithic concrete.
 - 2. Exterior horizontal and nonvertical plasterwork (stucco).

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.
- D. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.
- E. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.
 - a. Size: 100 sq. ft. in surface area.
 - b. 12"x12" of each selected color.

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 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 FIELD CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Exterior Plasterwork:
 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 2. Apply plaster when ambient temperature is greater than 40 deg F.
 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 1. Environmental product Declarations:
 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Sustainability Requirements:
 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich Building Systems.
 - c. MarinoWARE.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 3. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd..
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.
1. Provide paper-backed lath in locations indicated on Drawings.

2.3 ACCESSORIES

- A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO.
 - b. ClarkDietrich Building Systems.
 - c. Fry Reglet
 - d. MarinoWARE.
 2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
 3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
 4. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
 5. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
 6. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 7. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 8. Misc. trim as detailed.

2.4 AIR AND WATER-RESISTIVE BARRIER

- A. StoGuard Detail Components
1. Sheathing Joint Treatment, Rough Opening (RO) Protection, Counterflashing, and Penetrations:
 - a. Sto Gold Coat or Sto AirSeal: brush, spray or roller applied air and water-resistive barrier coating used with StoGuard Fabric reinforcement
- B. Static Joints and Seams
1. Sto RapidGuard: single component rapid drying gun-applied treatment for static joint transitions to dissimilar construction (i.e., masonry to frame wall), balcony floor slab-to-ceiling, and wall sheathing to foundation
- C. Static and Dynamic Joints
1. StoGuard Transition Membrane: flexible membrane for static joint transitions such as sheathing to dissimilar construction (i.e., masonry to frame wall), balcony floor slab-to-ceiling, and wall sheathing to foundation. Also used for dynamic joints such as floor line

deflection joints, masonry control joints, and expansion joints in masonry or frame wall construction.

2.5 MATERIALS

- A. Basis of Design: Provide StoQuik Gold Finish System or a comparable product by one of the following:
 - 1. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Textured Finishes
 - 1. Stolit DPR– high performance decorative and protective acrylic-based textured wall finish with integral color.
 - a. Texture: Fine
 - b. Color: as selected by Architect from Manufacturer's full range.
 - c. Sto Clear Coat Sealer.
- C. Primer
 - 1. StoPrime™ – acrylic-based smooth primer.
- D. Base Coat
 - 1. Sto BTS Xtra – one component polymer modified portland cement extra high build base coat.
- E. Surface Reinforcement
 - 1. Sto Mesh – nominal 4.5 oz/yd² (153 g/m²) glass fiber reinforcing mesh treated for compatibility with Sto materials
 - 2. Sto Detail Mesh – nominal 4.2 oz/yd² (142 g/m²) glass fiber reinforcing mesh treated for compatibility with Sto materials
 - 3. StoGuard Mesh – nominal 4.2 oz/yd² (142 g/m²) self-adhesive glass fiber reinforcing mesh treated for compatibility with Sto materials
- F. Leveler:
 - 1. Sto Wall Leveler and Patch
- G. Extruded Polystyrene (XPS) Insulation Board
 - 1. Foamular® CI-C Insulation: nominal 1.3 lb/ft³ (21 kg/m³) extruded polystyrene (XPS) rigid foam plastic insulation board in compliance with ASTM C578, Type X requirements, R-5 per inch (RSI – 0.88 per 25mm).
 - 2. Dupont™ Styrofoam™ Brand Panel Core 20 Insulation: nominal 1.8 lb/ft³ (28.8 kg/m³) extruded polystyrene (XPS) rigid foam plastic insulation board in compliance with ASTM C578, Type X requirements, R-5 per inch (RSI – 0.88 per 25mm).
- H. Drainage mat: Sto DrainScreen 6mm – nominal ¼-inch minimum tangled filament core drainage mat with fabric facing.
 - 1. Surface Burning, ASTM E 84: Flame Spread less than 25, Smoke Developed less than 450, Class A Building Material.
 - 2. Flame Propagation, NFPA 285: meets requirements for use on noncombustible construction

2.6 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in cement plaster.
- C. Bonding Compound: ASTM C 932.
- D. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
- E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.
- F. Building Paper as Bond Breaker: Water-vapor-permeable, asphalt-saturated kraft building paper that complies with ICC-ES AC38, Grade D.
- G. 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. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent by weight.

2.7 PLASTER MATERIALS AND MIXES

- A. Basis of Design: Subject to compliance with requirements, provide [Powerwall with Drainscreen by Sto Corp](#) or a comparable product by one of the following:
 - 1. Parex USA
 - 2. SonoWall BASF Corporation
- B. Stucco Base
 - 1. Proprietary mixture of portland cement, and proprietary ingredients mixed with clean, cool, and potable water in the field.
- C. Stucco Admix:
 - 1. 100% acrylic emulsion additive for Portland cement based products to enhance curing, adhesion, freeze-thaw resistance and workability and as an acrylic polymer bonding agent.
- D. Leveling and Reinforcing Coat:
 - 1. Stucco Level Coat™: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
 - 2. Reinforcing Meshes:
 - a. Standard Mesh: Weight 4.5 oz/yd² (153 g/m²) reinforcing mesh.
- E. Primer:
 - 1. Primer: 100% acrylic based primer to prepare surfaces for acrylic or elastomeric finishes.
- F. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - 1. Basis of Design: Subject to compliance with requirements, provide Stolit DPR, Fine Finish or a comparable product by one of the following:
 - a. Dryvit Systems, Inc.; Dryvit TAFS, Sand Pebble fine finish.
 - b. Parex LaHabra Perma Finish
 - 2. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

3.4 INSTALLING METAL LATH

- A. Metal Lath: Install according to ASTM C 1063.
 - 1. Partition Framing and Vertical Furring: Install flat-diamond-mesh lath.
 - 2. Flat-Ceiling and Horizontal Framing: Install flat-diamond-mesh lath.
 - 3. Curved-Ceiling Framing: Install flat-diamond-mesh lath.
 - 4. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.5 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:
 - 1. Install lath-type, external-corner reinforcement at exterior locations.
 - 2. Install cornerbead at interior locations.
- C. Control Joints: Locate as approved by Architect for visual effect and as follows:
 - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft..
 - b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft..
 - 2. At distances between control joints of not greater than 18 feet o.c.
 - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

- A. Mix proprietary products in accordance with manufacturer's instructions, including the applicable stucco system product data sheets and application guidelines.
- B. General: Comply with ASTM C 926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - 3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- C. Stucco Base:
 - 1. Scratch Coat:
 - a. Apply scratch coat to a minimum thickness of 3/8 in (9.5 mm), using sufficient trowel pressure to key stucco into lath or to create bond to substrates as applicable.
 - b. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
 - c. Moist cure scratch coat with clean potable water for at least 48 hours in accordance with ASTM C926 and the building codes following initial application (unless brown coat is applied as soon as the scratch coat has achieved sufficient rigidity to support the brown coat).
 - 2. Brown Coat:
 - a. Apply brown coat to a minimum thickness of 3/8 in (9.5 mm), using sufficient trowel pressure to key stucco into scratch coat.
 - b. Rod surface to true plane and float to densify.
 - c. Trowel to smooth and uniform surface to receive acrylic polymer finish coat.
 - d. Moist cure brown coat with clean potable water for at least 48 hours, in accordance with ASTM C926 and the building codes.
- D. Leveling and Reinforcing Coat:
 - 1. After Moist Curing, allow stucco base coat to air dry a minimum of 24 hours before applying the leveling and reinforcing coat.
 - 2. Using a stainless steel trowel, apply the stucco leveling coat over the stucco base coat at a thickness of 1/16 to 3/32 in (1.6 – 2.4 mm).
 - 3. Fully embed reinforcing mesh, either Stucco Mesh, 355 Standard Mesh or 358.10 Intermediate Mesh, into wet stucco level coat, including diagonal strips at corners of openings and trowel smooth. If Stucco Mesh or 355 Standard Mesh is used, seams are overlapped 2- 1/2 in (63 mm); if 358.10 Intermediate Mesh is used, seams are butted and covered by strips of 356 Detail Mesh.
 - 4. The acrylic primers and finishes can be applied as soon as the stucco leveling coat has dried, typically within 24 hours.
- E. Primer:
 - 1. Remove surface contaminants such as dust or dirt without damaging the substrate.
 - 2. Ambient and surface temperature must be 40°F (4°C) or higher during application and drying time. Supplemental heat and protection from precipitation must be provided as needed.
 - 3. Use only on surfaces that are sound, clean, dry, unpainted, and free from any residue that might affect the ability of the finish to bond to the surface.
 - 4. Parex Armourwall 300 Krak-Shield Stucco System
 - a. Before the application of the finish, the base coat must have cured a minimum of 24 hours or longer as required by conditions. Examine the cured base coat for any irregularities.

- b. Correct these irregularities to produce a flat surface.
 - 5. Apply primer as directed in manufacturer's product data sheet and application guide.
 - F. Plaster Finish Coats: Apply to provide float finish to match Architect's sample and as recommended by manufacturer to achieve texture indicated, using sufficient trowel pressure or spray velocity to bond finish to base coat.
 - 1. Protect finish coats from weather until completely dry.
 - G. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.
 - H. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.
 - I. Walls; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having 3/8-inch thickness on masonry, as follows:
 - 1. Portland and masonry cement mixes.
- 3.7 PLASTER REPAIRS
- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- 3.8 CLEANING AND PROTECTION
- A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 09 2116 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 3. Section 09 2216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
 - 4. Section 09 3000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 2. For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

5. Red List Compliance information: Provide documentation confirming no Red List chemical are present. Documentation to include one of the following:
 - a. Red List Free Declare ID number with VOC disclosure information.
 - b. Complete manufacturer-supplied ingredient list with a letter from the manufacturer confirming there are no Red List materials in proprietary ingredients.
 6. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs that conform to USGBC guidelines and have at least a cradle to gate scope
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 2. Apply or install final decoration indicated, including painting, 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.

1.5 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.

1.6 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.
- B. Sound-Rated Assemblies: For Sound-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.
- C. Environmental Certification: Provide materials carrying certification by one of the following:
 - 1. Greenguard Gold Certification
- D. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- E. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Provide a Product-Specific Type III Environmental Product Declaration (EPD), that meets the following parameters, and documents that each product's Global Warming Potential (GWP) is in lowest 60th percentile of the most recent Carbon Leadership Forum (CLF) BETA Embodied Carbon Baselines as found on EC3 and as listed below for reference:
 - 2. Embodied Carbon (GWP) Baselines: Finishes
 - a. Gypsum Board – 3000 kg CO₂eq per 1000 m²/277 kgCO₂ eq 1,000 per ft²
 - 3. System Boundary: Product Stage A1-A3.
 - 4. Declared Units: 1 square meter or 1 square foot.
 - 5. Product Category Rules:
 - a. ASTM International PCR for North American Glass Mat Gypsum Panels, v.1, 2016-08-01.
 - b. NSF International PCR for PCR for Gypsum Panel Products, v.1, 2019-07-17
 - 6. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- F. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- G. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- H. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- I. Red List Compliance: Insulation products cannot contain any Red List materials or chemical.
- J. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. 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. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
 3. Products:
 - a. United States Gypsum Company, LLC, "USG Sheetrock® Brand EcoSmart Panels Firecode® X".
 - b. Certaineed Type X Gypsum Board.
- B. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 1. Thickness: 1/4 inch.
 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- D. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 1. Core: 5/8 inch, Type X.
 2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
 4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 5. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
 6. Long Edges: Tapered.
 7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 4. Products:
 - a. USG sheetrock ecosmart type x mold tough
 - b. Gold Bond xp fire shield

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 1. Products: Subject to compliance with requirements, provide one of the following:

- a. [CertainTeed Corporation; GlasRoc.](#)
 - b. [G-P Gypsum Corporation; Dens-Glass Gold.](#)
 - c. [National Gypsum Company; Gold Bond eXP.](#)
 - d. [United States Gypsum Co.; Securock.](#)
2. Type and Thickness: Type X, 5/8 inch thick.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 1. [Products](#): Subject to compliance with requirements, provide one of the following:
 - a. [CertainTeed Corp.](#); FiberCement Underlayment or BackerBoard.
 - b. [National Gypsum Company, Permabase Cement Board.](#)
 - c. [USG Corporation; DUROCK Cement Board.](#)
 2. Thickness: 5/8 inch.
 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 or Paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Exterior Trim: ASTM C 1047.
 1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- 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, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
- D. Custom Trim Components: Edge trim system for transitions between drywall and suspended ceilings. Extruded aluminum alloy 6063 trim channel,
 1. Basis of Design: Armstrong Axiom.
 - a. Provide trim as indicated on 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 Sheathing 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, rounded or beveled panel edges, 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.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Exterior Applications:
 - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. 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 MULLION TRIM CAP ASSEMBLIES

- A. Premanufactured aluminum and compressible material to connect end of gypsum wallboard partitions to aluminum mullions of Storefront and Curtain Wall systems.
 - 1. Manufacturers: Subject to compliance with requirements, provide assembly systems by one of the following:
 - a. Gordon Incorporated; Mullion Mate Adjustable Partition Closure.
 - b. Mull-It-Over Products.
 - c. Rieger Architectural Products; Adjustable Partition Closures.
- B. Provide sound-barrier mullion trim caps of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in lengths of sufficient additional length to allow for field trimming to required length to match variations in construction tolerances of adjacent systems.
 - 2. Provide STC-rating to match partition rating.
- C. Provide fire-resistance-rated assembly to match partition rating.
 - 1. Standard Conditions: Assembly fire rating of 1 hour per ANSI/UL2079 and CAN/ULC S115.
 - a. UL Joint System No. WW-S-1039 for 1 hour assembly.
 - b. UL Joint System No. WW-S-1041 for 2 hour assembly.
 - 2. Unique or Non-Standard Conditions: Subject to review and engineered ruling by manufacturer.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Size mullion trim cap to accommodate thermal movement.
- E. Components:
 - 1. Aluminum Extrusions:
 - a. Thickness: 0.125 inch.
 - b. Profile: As selected and approved by Architect to allow solid attachment and fastening to the partition wall framing.
 - 2. Sound Absorbing Foam:
 - a. Resistant to smoke, flame, and microbial growth.
 - b. Fire Rating: ASTM E 84 Class 1.
 - c. Fungi Resistance: Zero rating per ASTM G 21.
 - 3. Compressible Foam: Between edge of extrusion and interior face of curtain wall glass.
 - a. Thickness: Standard 1/2 inch; 3/4; 1 inch; or 1-1/2 inch; as required to accommodate mullion deflection.
 - b. Color: As selected by Architect from full range of standard colors.
 - 4. Fasteners:
 - a. Self-Tapping or appropriate threaded fastener.
 - b. Compatible with all materials fasteners within contact and not causing galvanic corrosion.
 - 5. Snap Cover: Snap-on fastener cover.
 - 6. Acoustical Sound Sealant: Acrylic latex based.
 - 7. Accessories: Provide necessary and related parts and tools to complete installation.
- F. Aluminum Finishes:
 - 1. High-Performance Organic Finish: 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 manufacturer's written instructions.
 - a. Color and Gloss: Match adjacent aluminum storefront and curtain wall.

2.9 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. 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 thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Absorptive Fabric Layer: Black Soundex sheet membrane shop applied to backs of panels. Non-woven fabric with Class 1 fire rating. Perforated panels with absorbing material to achieve an NRC of 0.70-0.80 minimum.
 - 1. Products:
 - a. Owens Corning – SelectSound Black Acoustical Board
 - b. MBI Products – Blackout Theater Board
 - c. Thermafiber – SoundZero
 - d. Armstrong BioAcoustic Infill panel.
 - e. Knauf Black Acoustical Board.

- E. 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. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Pecora Corporation; AIS-919.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- F. Thermal and Acoustic Insulation: As specified in Section 07 2100 "Thermal Insulation."
- G. Moldable putty for application to electrical boxes and other penetrations of acoustical barriers.
 - 1. Pre-formed 1/8-inch pads
 - 2. Non-toxic, asbestos-free
 - 3. Acceptable Product and Manufacturer:
 - a. Quiet Putty QP-380 by Quiet Solution; 1250 Elko Dr.; Sunnyvale, CA 94089; 800/797-8159
 - b. Outlet Box Pads by Harry A. Lowry & Associates, 11176 Penrose St., Sun Valley, CA 91352, 818/768-4661

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 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 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. 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-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces
- H. with acoustical sealant.
- I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- J. Sound-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.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Wallboard Type X: Vertical surfaces unless otherwise indicated.
 2. Flexible Type: Apply in double layer at curved assemblies.
 3. Ceiling Type: Ceiling surfaces.
 4. Impact-Resistant Type: As indicated on Drawings.
 5. Mold-Resistant Type: As indicated on Drawings.
- 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. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. 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 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. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. 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.
- E. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF 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 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 where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use where indicated.
 6. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 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, rounded or beveled edges, 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: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 1. Level 3: Where indicated on Drawings.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
 - 3. Level 5: At Rotunda and where indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
 - b. Level 5 Finish : SHEETROCK Brand *Tuff-Hide* spray applied primer/skim coat: At corridors and stairwells, and where indicated
 - 4. Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint compound specified for third coat, or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.
 - 5. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
 - 6. For Level 1 gypsum board finish, 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.
 - 7. For Level 1 gypsum board finish, 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.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 INSTALLATING MULLION TRIM CAPS

- A. Measure and cut sound barrier wall end cap to proper lengths.
- B. Notch around horizontal mullions, sills, or other obstructions leaving appropriate gap for differential movement between the sound barrier wall end cap and the obstruction.
- C. Apply continuous bead of acoustical sealant to the unexposed side of extruded aluminum surface that will be in contact with the drywall edge.

- D. Place sound barrier wall end cap on the vertical surface of the drywall partition wall and loosely install fasteners in the top and bottom slotted holes of the wall end cap.
- E. Plumb the wall end cap leaving recommended gap spacing between the interior glass surface and the wall end cap. Foam gasket to be in contact with glass.
- F. Tighten top and bottom fasteners to secure end cap.
- G. Install additional fasteners at 12 inches on-center, minimum.
- H. Install snap cover to conceal fasteners.
- I. Apply color matched sealant at joints of dissimilar materials.

3.8 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report 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 above-ceiling observation.

3.9 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 3000

TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Quarry tile.
 - 2. Porcelain tile.
 - 3. Stone tile.
 - 4. Glazed wall tile.
 - 5. Waterproof/anti-fracture membrane for thinset applications.
 - 6. Metal edge strips.
- B. Related Sections:
 - 1. Section 07 9200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 09 2900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 2. Laboratory tests for flooring products, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: Laboratory tests for flooring products, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- E. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association.
 - 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
 - 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
 - 4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of gauged porcelain tile/gauged porcelain tile panels and slabs and large format tile.
- 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 each type of floor tile installation.
 - 2. Build mockup of each type of wall tile installation.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Waterproof membrane.
 - 2. Crack isolation membrane.
 - 3. Joint sealants.
 - 4. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Provide Lead-free tile for all tile installations.
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
- G. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- H. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- I. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- J. Additional Low-emitting requirements – Paints and Coatings:
 - 1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- K. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".

L. Additional Low-emitting requirements – Flooring:

1. FloorScore Compliance: Hard Surface flooring and Adhesives shall comply with requirements of FloorScore Standard.

M. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 TILE PRODUCTS

A. Tile Type: .

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on finish legend.
2. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
3. Grout Color: As selected by Architect from manufacturer's full range.

B. Tile Trim Units

1. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base for Thin-Set Mortar Installations: Straight, module size to match adjacent tile size.
 - b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size to match adjacent tile.
 - c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - d. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - e. Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
 - f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Schluter Systems L.P.; KERDI.

2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Schluter Systems L.P.; DITRA.

2.6 SETTING MATERIALS

- A. Medium-Bed, Modified Dry-Set Mortar (Thin Set): ANSI A118.4.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Custom Building Products or comparable product by one of the following:
 - a. ARDEX Americas.
 - b. LATICRETE SUPERCAP, LLC.
 - c. MAPEI Corporation.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Polymer-Modified Tile Grout: ANSI A118.7.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide TEC® Power Grout®, or comparable product by one of the following:
 - a. ARDEX Americas.
 - b. Custom Building Products
 - c. LATICRETE SUPERCAP, LLC.
 - d. MAPEI Corporation.
 - 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic, designed specifically for flooring applications; white zinc alloy or stainless-steel, ASTM A 666, 300 Series exposed-edge material.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Schluter Systems LP or comparable product by one of the following:
 - a. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.
- D. Edge protecting metal trim for protecting outside corners:
 - 1. Basis of Design: Schluter Jolly
 - 2. Material: Color coated aluminum.
 - 3. Size: as selected by Architect from full range.
 - 4. Color: as selected by Architect from full range.

- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American, an Oldcastle company.
 - b. Custom Building Products.
 - c. Summitville Tiles, Inc.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
 - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: As narrow as tile will allow, but in no case wider than ¼ inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Install waterproofing/anti-fracture membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- C. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floors on Concrete:

- 1. F122: Thin-set mortar on waterproof membrane.
 - a. Thinset Mortar: Modified dry-set mortar.
 - b. Grout: High-performance grout.

- B. Interior Walls, Wood or Metal Studs or Furring:

- 1. W244: Thin-set mortar on cementitious backer units or fiber cement underlayment.
 - a. Thinset Mortar: Modified dry-set mortar.
 - b. Grout: High-performance grout.

- C. Bathtub/Shower Wall Installations, Wood or Metal Studs or Furring:

- 1. Ceramic Tile Installation: TCNA B412; thinset mortar on cementitious backer units or fiber-cement backer board.
 - a. Thinset Mortar: Modified dry-set mortar.
 - b. Grout: High-performance grout.

END OF SECTION

SECTION 09 6240

STRUCTURAL GLASS FLOORING

A. PART 1 – GENERAL

1.1 Related Documents

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

1.2 Summary

- A. This Section includes work associated with translucent glass floor WS-1 Walkable Skylight.
 - 1. Recessed walkable skylights.

1.3 References

- A. Consumer Product Safety Commission (CPSC): CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. Glass Association of North America (GANA): GANA - Glazing Manual.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to glass floor assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including attachment to structural members.
 - 2. Review at meeting:
 - a. Coordination with primary floor system and floor finishes.
 - b. Schedule, sequence, and method for installing glass floor and coordination with other work.
 - c. Safety procedures.
 - d. Pre-installation test reports and recommendations.
 - e. Chemical compatibility of support framing, glass panels, sealants, and other glazing materials.
 - f. Protection of adjacent items and finishes.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's standard product data for each type of product.
- B. LEED Submittals: Comply with Section 018113.
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. MR Credit 2: BPDO – Environmental Product Declarations
 - a. For glass, if available: Product-specific declaration or Industry-wide EPD or product-specific EPD.
 - 1) Include EPD Summary.
 - 3. MR Credit 4: BPDO – Material Ingredients
 - a. For glass, if available: Material Ingredient Report.
 - 4. IQ Credit 2: Low-Emitting Materials
 - a. For interior wet-applied sealant: Certificate stating compliance with California Department of Public Health (CDPH) Standard Method including TVOC range.
 - 1) Include product data stating VOC content in grams per Liter (g/L).
 - 2) Include volume of material applied per product in liters (L).
 - b. For skylights: Certificate stating compliance with California Department of Public Health (CDPH) Standard Method including TVOC range.
 - 5. EQ Credit 7: Daylight
 - a. For all exterior glazing: Visible light transmittance value.
- C. Shop drawings:
 - 1. Include plans, elevations, sections, and details of glass flooring and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
- D. Samples for Verification: For each type of structural glass flooring and accessory, approximately 6 inches square and of same thickness and material indicated for the Work and showing the full range of normal color, pattern and texture variations expected.
- E. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer's installation and maintenance instructions.
- B. Certificates or test reports demonstrating components and methods meet specified requirements.
- C. Data showing compliance with manufacturer's and installer's qualifications. Provide descriptions, locations, photographs, references, and completion dates for previous projects.

1.7 QUALITY ASSURANCE

- A. Manufacturer: Minimum 2 years experience manufacturing similar products.
- B. Installer: Minimum 2 years experience installing similar systems, and acceptable to the structural glass flooring manufacturer.
- C. Delegated Design: Engineer glass flooring systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the jurisdiction of the project.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain each type of structural glass flooring panels and components from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- E. Physical Performance: Provide structural glass flooring, including anchorage, capable of withstanding, without defects, the effects of the following:
 - 1. Structural loads, including wind, snow, seismic or other anticipated loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
- F. Performance: Provide structural glass flooring which does not exhibit any of the following defects after installation:
 - 1. Water leakage.
 - 2. Noise or vibration created by wind and thermal and structural movements.
 - 3. Framing members transferring stresses to glazing.
 - 4. Loosening or weakening of fasteners, attachments, and other components.
 - 5. Sealant failure.
- G. Safety glazing: Comply with Consumer Product Safety Commission 16 CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.
- H. Mock-up
 - 1. Prepare in-place mock-up illustrating construction method for glass floor in locations as selected by Architect. Mock-up shall demonstrate performance and establish workmanship quality standard.
 - 2. Mock-up shall be portion of floor assembly with glass panels, secondary support framing, spacers, setting blocks, backers, and structural silicone sealant. Construct with components proposed for actual installation.
 - 3. Test mock-up with applied live loads to verify structural capacity and test for water leakage.
 - 4. Submit report describing tests, results, and any modifications made to correct deficiencies or to improve performance.

5. Do not proceed with installation until mock-up has been inspected and accepted by Architect.

1.8 Material Storage and Handling

- A. Store material in dry place, off the ground, where temperature will not exceed 90 degrees Fahrenheit.
- B. Handle material to prevent damage to finished surfaces. Do not install scratched or damaged components.
- C. After installation, protect finished surfaces from damage caused by ensuing work.

1.9 WarrantIES

- A. Glass fabricator's warranties: 5 years warranty to cover replacement of laminated glass units in event of delamination, edge separation, and blemishes.
- B. Installer's 5 years warranty to cover installation against defects and failure to perform and remain air and water tight. Warranty to provide for required repairs.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section when available.
 1. Environmental product Declarations:
 2. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- B. Interior wet-applied sealants: Comply with low-emitting requirements in Division 01 Section "Sustainable Design Requirements - LEED."
- C. Skylight emissions: Comply with emissions requirements of CDPH Standard Test Method in Section 018113.

2.2 WALKABLE SKYLIGHT COMPONENTS

- A. Recessed Walkable Skylights: Provide fully glazed, fully assembled engineered SkyFloor walkable skylights by Glass Flooring Systems, Inc. with the following characteristics:
 1. Application: Exterior.
 2. Type: SkyFloor Custom Unit, Custom configuration.
 3. Frame Color: Custom.
 4. Thermal Break: Required.
 5. Glass: Standard float glass, textured walking surface.
 6. Glass Assembly: Three layers of 3/8 inch glass with Eastman Safety PVB or SentryGlass interlayers as applicable.
 - a. Interlayer: Translucent

- b. Finish: as selected from Architect from manufacturers full range – Bel Air T or Hudson T.
- 7. Slip-Resistant Floor Glass: SEVASA CriSamar
 - a. System and finish as selected by Architect from full range.
- 8. Aluminum Framing: Alloy 6063-T6 extruded aluminum.
- 9. Clips and Fasteners: Stainless steel.
- 10. Sealant: Dow Corning 995 structural sealant.
- 11. Integrated Snap-On Setting Blocks: 80-90 shore hardness.
- 12. Cap: Adjustable with backer rod strip.
- 13. Lighting Option: Integrated LED lighting at perimeter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for existing conditions, installation tolerances, and other conditions affecting performance of structural glass flooring.
 - 1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
 - 2. Verify that pitch of 1/8 inch per foot is achievable.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install glass flooring in accordance with manufacturer's instructions and approved submittals and the following:
 - 1. Do not use panels with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
 - 2. Rigidly secure nonmovement joints.
 - 3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 4. Seal joints watertight.
- B. Erection Tolerances: Install glass flooring systems to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/16 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to **1/8 inch in 12 feet** but no greater than **1/2 inch** over total length.

3.3 CLEANING AND PROTECTION

- A. Protect structural glass flooring from damage during construction until date of Substantial Completion. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Clean glass on both surfaces.
- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from during the construction period.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient stair accessories.
 - 3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Red List Compliance information: Provide documentation confirming no Red List chemical are present. Documentation to include one of the following:
 - a. Red List Free Declare ID number with VOC disclosure information.
 - b. Complete manufacturer-supplied ingredient list with a letter from the manufacturer confirming there are no Red List materials in proprietary ingredients.
 - 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 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 DELIVERY, STORAGE, AND HANDLING

- A. 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 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section.
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- B. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.

2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".

E. Additional Low-emitting requirements – Flooring:

1. FloorScore Compliance: Hard Surface flooring and Adhesives shall comply with requirements of FloorScore Standard.

- F. Red List Compliance: flooring products cannot contain any Red List materials or chemical.

G. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide Tarkett Johnsonite or a comparable product by one of the following:

1. Nora systems Inc.
2. Roppe Corporation USA
3. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

2.3 RESILIENT BASE

- A. Resilient Base Standard: ASTM F 1861 Type TS (rubber, vulcanized thermoset) or ASTM F 1861 Type TP (rubber, thermoplastic).

1. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
2. Style and Location:
 - a. Style A, Straight: In areas with carpet.
 - b. Style B, Cove: In areas with resilient flooring.

- B. Thickness: 0.125 inch.

- C. Height: 4 inches.

- D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

- E. Outside Corners: Job formed.

- F. Inside Corners: Job formed.

- G. Colors: As indicated by manufacturer's designations.

2.4 STAIR ACCESSORIES

- A. 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.

- B. Basis of Design: Subject to compliance with requirements, provide products by Roppe or a comparable product by one of the following:

1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
2. Flexco, Inc.
3. Johnsonite.

- C. Stair Treads: ASTM F 2169.
 - 1. Type: TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic).
 - 2. Class: 1 (smooth, flat).
 - 3. Group: 1 (embedded abrasive strips).
 - 4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
 - 5. Nosing Height: 2 inches.
 - 6. Thickness: 1/4 inch and tapered to back edge.
 - 7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
 - 8. Integral Risers: Smooth, flat; in height that fully covers substrate.
- D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
- E. Locations: Provide rubber stair accessories in areas indicated.
- F. Colors and Patterns: As indicated by manufacturer's designations.

2.5 MOLDING ACCESSORY

- A. Description:
 - 1. Cap for cove carpet.
 - 2. Cap for cove resilient flooring.
 - 3. Carpet bar for tackless installations.
 - 4. Carpet edge for glue-down applications.
 - 5. Nosing for carpet.
 - 6. Nosing for resilient flooring.
 - 7. Reducer strip for resilient flooring.
 - 8. Joiner for tile and carpet.
 - 9. Transition strips.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide rubber molding accessories in areas indicated.
- D. Colors and Patterns: As indicated by manufacturer's designations.

2.6 INSTALLATION MATERIALS

- A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- C. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. All adhesives will be required to carry Cradle to Cradle Silver certification score or higher, including the following:
 - a. truRenew Carpet Flooring Adhesive SP by WF Taylor
 - b. Shaw 5100 Adhesive
 - c. XL Brands flooring adhesives
- D. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

- E. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

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.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
 - 1. Do not install resilient products until materials are the same temperature as space where they are to be installed. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

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 practical 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. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal 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.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 7200

WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Textile wall covering.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Product Data: Laboratory test reports for interior products, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.
- D. Samples for Initial Selection: For each type of wall covering indicated.
- E. Samples for Verification: Full width by 36-inch-long section of wall covering.
 - 1. Sample from same print run or dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
- F. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wall coverings 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. Wall-Covering Materials: For each type, full-size units equal to 5 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
- 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 wall area as directed by Architect. Include intersection of wall and ceiling, corners, and perimeters. Comply with requirements in ASTM F 1141 for appearance shading characteristics.
 - 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.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. 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.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- D. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- E. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 WALL COVERINGS

- A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.3 TEXTILE WALL COVERING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the finish schedule or comparable product by one of the following:
 - 1. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
- B. Wall-Covering Standard: Provide strippable wall coverings that comply with ASTM F 793 for Category VI, Type III, Commercial Serviceability products.
 - 1. Products: Subject to compliance with requirements, provide product listed on Drawings.

- C. Test Responses:
 - 1. Colorfastness to Wet and Dry Crocking: Passes AATCC 8, Grade 3, minimum.
 - 2. Colorfastness to Light: Passes AATCC 16, Option 1 or 3, Grade 4, minimum, at 40 hours.
- D. Colors, Textures, and Patterns: as indicated on finish legend.

2.4 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 9123 "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 4. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

- A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
- B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
 - 1. If recommended by manufacturer for solid-color, even-texture, or random-match wall coverings, reverse every other strip.
- D. Install reversing every other strip.
- E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- F. Match pattern 72 inches above the finish floor.
- G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- H. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- I. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.
- J. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 9113

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- 1. Surface preparation and application of paint systems on exterior substrates.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" and Section 051213 "Architecturally Exposed Structural Steel Framing" for shop priming of metal substrates.
- 2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
- 3. Section 09 9300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Sustainable Design Submittals:
 - 1. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples for Initial Selection: For each type of topcoat product.

- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. 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.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.

2. [PPG Architectural Coatings.](#)
3. [Sherwin-Williams Company \(The\).](#)

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- D. [Building Product Disclosure Requirements](#): Provide Building Product Disclosure documentation for products used in this section where available.
1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- E. Colors: Match Architect's samples.

2.3 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 CMUs): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. 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.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. 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.
- I. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification 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. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- 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 and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.

3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- 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. Concrete Substrates, Nontraffic Surfaces:

1. Latex System MPI EXT 3.1A:
 - a. Prime Coat: Primer, Alkali Resistant Water Based MPI #3
 - 1) Benjamin Moore Ultra Spec High Build Masonry Primer
 - 2) PPG Paints; Seal Grip Int/Ext Acrylic Universal Primer/Sealer
 - 3) Sherwin Williams: Prep-Rite ProBlock Interior/Exterior Latex Primer/Sealer
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Flat, MPI #10:
 - 1) Benjamin Moore Ultra Spec Exterior Flat Finish N447 (45 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Flat, 6-610XI Series.
 - 3) Sherwin Williams: Resilience Exterior Latex Flat
 - d. Topcoat: Low sheen, MPI #15:
 - 1) Benjamin Moore Ultra Spec EXT Satin N448 (46 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Satin, 6-2045XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin Williams: Resilience Exterior Latex Satin
 - e. Topcoat: Semi-gloss, MPI #11:
 - 1) Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Semi-Gloss, 56-510XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin Williams: Resilience Exterior Latex

B. CMU Substrates:

1. High-Performance Architectural Latex System MPI EXT 4.2A:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4, X-Green 4:
 - 1) Benjamin Moore® Ultra Spec® Hi-Build Masonry Block Filler 571 (45 g/L).
 - 2) PPG Paints: Speedhide Interior/Exterior Masonry Hi Fill Latex Block Filler, 6-15XI;
 - 3) Sherwin Williams: PrepRite Int/Ext Block Filler
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Flat, MPI #10:
 - 1) Benjamin Moore Ultra Spec Exterior Flat Finish N447 (45 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Flat, 6-610XI Series.
 - 3) Sherwin Williams: Resilience Exterior Latex Flat
 - d. Topcoat: Low sheen, MPI #15:
 - 1) Benjamin Moore Ultra Spec EXT Satin N448 (46 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Satin, 6-2045XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin Williams: Resilience Exterior Latex Satin
 - e. Topcoat: Semi-gloss, MPI #11:
 - 1) Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L).

- 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Semi-Gloss, 56-510XI Series; applied at 1.4 mils dft per coat.
- 3) Sherwin Williams: Resilience Exterior Latex

C. Galvanized-Metal Substrates:

1. Alkyd System MPI EXT 5.3B:
 - a. Prime Coat: Primer, galvanized, cementitious MPI #26
 - 1) Benjamin Moore: As recommended in writing by topcoat manufacturer.
 - 2) PPG Paints; As recommended in writing by topcoat manufacturer
 - 3) Sherwin Williams: As recommended in writing by topcoat manufacturer
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5) MPI #94
 - 1) Benjamin Moore: As recommended in writing by topcoat manufacturer.
 - 2) PPG Paints; As recommended in writing by topcoat manufacturer
 - 3) Sherwin Williams, Pro Industrial DTM Alkyd Semi-Gloss.
 - d. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6) M.PI #9
 - 1) Benjamin Moore: Corotech Alkyd Urethane Enamel
 - 2) Benjamin Moore® Super Spec HP® Urethane Alkyd Gloss Enamel P22 (394 g/L).
 - 3) PPG Paints; Sil-Shield High-Gloss Silicone Alkyd Enamel.
 - 4) Sherwin Williams: Protecto and Marine Seaguard 1000 Marine

D. Wood Substrates: Architectural woodwork Doors Windows and wood trim.

1. Latex over Latex Primer System MPI EXT 6.3L:
 - a. Prime Coat: Primer, latex for exterior wood, MPI #6.
 - 1) Benjamin Moore Fresh Start High-Hiding All Purpose Primer
 - 2) PPG Paints; Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer
 - 3) Sherwin Williams: PrepRite ProBlock Primer/Sealer Interior/Exterior Latex
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Flat, MPI #10:
 - 1) Benjamin Moore Ultra Spec Exterior Flat Finish N447 (45 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Flat, 6-610XI Series.
 - 3) Sherwin Williams: Resilience Exterior Latex Flat
 - d. Topcoat: Low sheen, MPI #15:
 - 1) Benjamin Moore Ultra Spec EXT Satin N448 (46 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Satin, 6-2045XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin Williams: Resilience Exterior Latex Satin
 - e. Topcoat: Semi-gloss, MPI #11:
 - 1) Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L).
 - 2) PPG Paints; Speedhide Exterior 100% Acrylic Latex Semi-Gloss, 56-510XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin Williams: Resilience Exterior Latex
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.
 - 1) Benjamin Moore As recommended in writing by topcoat manufacturer.
 - 2) PPG Paints; Protective and Marine Coatings, Pitt-Tech Plus Ep Dtm Acrylic Gloss.
 - 3) Sherwin Williams: Pro-Industrial DTM Acrylic Gloss

END OF SECTION

SECTION 09 9123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" and Section 05 1213 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
 - 2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 05 5113 "Metal Stairs" for shop priming metal pan stairs.
 - 4. Section 09 9300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

2. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - C. Samples for Initial Selection: For each type of topcoat product.
 - D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 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.
 - E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- 1.5 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.
- 1.6 QUALITY ASSURANCE
- A. 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 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.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.
- 1.8 FIELD CONDITIONS
- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
 - B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Benjamin Moore & Co.
 2. Dunn-Edwards Corporation.
 3. Ecos Paints
 4. Kelly-Moore Paint Company Inc.
 5. PPG Architectural Coatings.
 6. Sherwin-Williams Company (The).

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.
 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.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
1. 01 8113 "Sustainable Design Requirements".
 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
1. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- E. Additional Low-emitting requirements – Paints and Coatings:
1. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions"
- F. Colors: Match Architect's samples.

2.3 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 coatings 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. 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.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. 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.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. 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.

- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 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. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

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 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 1. High-Performance Architectural Latex System, MPI INT 3.1C:
 - a. Prime Coat: Primer, Alkali Resistant Water Based MPI #3
 - 1) Benjamin Moore Ultra Spec High Build Masonry Primer
 - 2) PPG Paints; Seal Grip Int/Ext Acrylic Universal Primer/Sealer
 - 3) Sherwin Williams: Prep-Rite ProBlock Interior/Exterior Latex Primer/Sealer
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 2) PPG Paints; Speedhide Max Eggshell, 6-9310 Series.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel B41W01951
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 2) PPG Paints; Speedhide Max Satin, 69410.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140 X-Green.
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N546.
 - 2) PPG Paints; Speedhide Max Lo Lustre, 6-9610.
 - 3) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - f. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141 X-Green.

- 1) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N546.
- 2) PPG Paints; Lifemaster Interior 100% Acrylic Semi-Gloss, 59211
- 3) Sherwin Williams Pro Industrial Acrylic Latex Semi-Gloss

B. CMU Substrates:

1. High-Performance Architectural Latex System, MPI INT 4.2D, MPI INT 4.2P:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4, X-Green 4:
 - 1) Benjamin Moore® Ultra Spec® Hi-Build Masonry Block Filler 571 (45 g/L).
 - 2) PPG Paints: Speedhide Interior/Exterior Masonry Hi Fill Latex Block Filler, 6-15XI;
 - 3) Sherwin Williams: PrepRite Int/Ext Block Filler
 - b. Prime Coat: Primer, Alkali Resistant Water Based MPI #3
 - 1) Benjamin Moore Ultra Spec High Build Masonry Primer
 - 2) PPG Paints; Seal Grip Int/Ext Acrylic Universal Primer/Sealer
 - 3) Sherwin Williams: Prep-Rite ProBlock Interior/Exterior Latex Primer/Sealer
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 2) PPG Paints; Speedhide Max Eggshell, 6-9310 Series.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel B41W01951
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 2) PPG Paints; Speedhide Max Satin, 69410.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - f. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140 X-Green.
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N546.
 - 2) PPG Paints; Speedhide Max Lo Lustre, 6-9610.
 - 3) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - g. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N546.
 - 2) PPG Paints; Lifemaster Interior 100% Acrylic Semi-Gloss, 59211
 - 3) Sherwin Williams Pro Industrial Acrylic Latex Semi-Gloss

C. Steel Substrates:

1. High-Performance Architectural Latex System, MPI INT 5.1:
 - a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.
 - 1) Benjamin Moore® Super Spec HP® Alkyd Metal Primer P06 (326 g/L).
 - 2) PPG Paints; Speedhide Rust Inhibitive Primer.
 - 3) Sherwin Williams: Pro Industrial Kem Bond HS
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - a. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 2) PPG Paints; Speedhide Max Eggshell, 6-9310 Series.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel B41W01951
 - b. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 2) PPG Paints; Speedhide Max Satin, 69410.

- 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140 X-Green.
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N546.
 - 2) PPG Paints; Speedhide Max Lo Lustre, 6-9610.
 - 3) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - d. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N546.
 - 2) PPG Paints; Lifemaster Interior 100% Acrylic Semi-Gloss, 59211
 - 3) Sherwin Williams Pro Industrial Acrylic Latex Semi-Gloss
- D. Metal decking, bar joists, exposed ductwork
 - 1. Water-Based Dry-Fall System MPI INT 5.1CC:
 - a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.
 - 1) Benjamin Moore® Super Spec HP® Alkyd Metal Primer P06 (326 g/L).
 - 2) PPG Paints; Speedhide Rust Inhibitive Primer.
 - 3) Sherwin Williams: Pro Industrial Kem Bond HS
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Topcoat: flat, MPI #118.
 - 1) Benjamin Moore® Latex Dry Fall Flat 395 (46 g/L).
 - 2) PPG Paints; Speedhide Super Tech WB Interior Latex Dry Fog, Flat 6-725XI Series.
 - 3) Sherwin Williams Pro Industrial Waterborne Acrylic Dryfall B42W02181
 - d. Topcoat: Dry fall, latex (MPI Gloss Level 3), MPI #155.
 - 1) Benjamin Moore® Latex Dry Fall Eggshell 396.
 - 2) PPG Paints; Speedhide Super Tech WB Interior 100% Acrylic Latex Dry Fog, Eggshell 6-724XI Series.
 - 3) Sherwin Williams Pro Industrial Waterborne Dryfall Eg-shel B42W02182
 - e. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.
 - 1) Benjamin Moore® Latex Dry Fall Semi-Gloss 397.
 - 2) PPG Paints; Speedhide Super Tech WB Interior 100% Acrylic Latex Dry Fog, Semi-Gloss 6-727XI Series.
 - 3) Sherwin Williams Pro Industrial Waterborne Dryfall Semi-Gloss B42W02183
- E. Wood Substrates: Wood trim and Architectural woodwork.
 - 1. High-Performance Architectural Latex System, MPI INT 6.3A:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - 1) Benjamin Moore® Multi-purpose primer 067
 - 2) PPG Paints; Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer 17-921XI Series
 - 3) Sherwin Williams PrepRite ProBlock Primer Sealer B51W00620
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - a. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 2) PPG Paints; Speedhide Max Eggshell, 6-9310 Series.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel B41W01951
 - b. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 2) PPG Paints; Speedhide Max Satin, 69410.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140 X-Green.

- 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N546.
 - 2) PPG Paints; Speedhide Max Lo Lustre, 6-9610.
 - 3) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - d. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N546.
 - 2) PPG Paints; Lifemaster Interior 100% Acrylic Semi-Gloss, 59211
 - 3) Sherwin Williams Pro Industrial Acrylic Latex Semi-Gloss
- F. Gypsum Board and Plaster Substrates:
1. High-Performance Architectural Latex System, MPI INT 9.2B:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - 1) Benjamin Moore Fresh Start High-Hiding All Purpose Primer
 - 2) PPG Paints; Speedhide Zero Interior Zero VOC Latex Sealer 6-4900XI
 - 3) Sherwin Williams: ProMar 200 Zero Interior Latex Primer B28W08150.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Low Sheen N537.
 - 2) PPG Paints; Speedhide Max Eggshell, 6-9310 Series.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel B41W01951
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Latex Eggshell N538.
 - 2) PPG Paints; Speedhide Max Satin, 69410.
 - 3) Sherwin Williams ProMar 200 Interior Acrylic Latex Eg-Shel
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140 X-Green.
 - 1) Benjamin Moore® Ultra Spec® 500 Interior Semi-Gloss N546.
 - 2) PPG Paints; Speedhide Max Lo Lustre, 6-9610.
 - 3) Sherwin Williams ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - f. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141 X-Green.
 - 1) Benjamin Moore Ultra Spec 500 Interior Latex Gloss N546.
 - 2) PPG Paints; Lifemaster Interior 100% Acrylic Semi-Gloss, 59211
 - 3) Sherwin Williams Pro Industrial Acrylic Latex Semi-Gloss

END OF SECTION

SECTION 09 93 00

STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and application of wood finishes on the following substrates:
 - 1. Exterior Substrates:
 - a. Exposed lumber found in fences and gates, and misc wood indicated on the drawings to receive stain.
- B. Related Requirements:
 - 1. Division 09 Section "High Performance Coatings" for transparent high-performance coatings on concrete.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of product indicated.

- C. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square.
 - 2. Label each Sample for location and application area.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color 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 type of finish system and substrate.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of stain color selections will be based on mockups.
 - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.6 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.

1.7 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg. F.
- B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg. F. above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. All interior locations and exterior locations outside of animal habitat & animal reach zones: provide products by Hallman Lindsay, Madison, WI.
2. All Exterior locations in animal habitats or within animal reach zones: provide products by Eco Safety Products, Phoenix, AZ.

2.2 MATERIALS, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each finish system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
- B. Stain Colors: As selected by Architect from manufacturer's full range.

2.3 STAINS & SEALERS

- A. Stain, Exterior – Outside of Animal Habitats & animal reach zones:
1. Semi-Transparent
 2. Waterborne Systems
 3. 1st Coat: Sherwin Williams – Superdeck Exterior Waterborne Semi-Solid Color Stain.
 4. 2nd Coat: Sherwin Williams – Superdeck Exterior Waterborne Semi-Solid Color Stain.

2.4 SOURCE QUALITY CONTROL

- A. Testing of Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If 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 wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates 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 hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Exterior Wood Substrates:
 - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
 - 2. Prime edges, ends, faces, undersides, and backsides of wood.
 - a. For solid hide-stained wood, stain edges and ends after priming.
 - b. For varnish-coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.

- c. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

END OF SECTION 09 93 00

SECTION 09 97 13
HIGH-PERFORMANCE EPOXY COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior Gypsum Wallboard for Interior Use
 - 2. Concrete Masonry Units (CMU)
- B. Related Sections include the following:
 - 1. Division 09, Section "Gypsum Board"
 - 2. Division 04, Section "Concrete Masonry Units"

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: Provide finish coating color selection from TNEMEC Company, Inc.
- C. 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.

1.4 QUALITY ASSURANCE

- A. Material Performance Criteria:
 - 1. Products: Provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test submitted and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.
- B. Applicator Qualifications:
 - 1. Preparation and Workmanship: A firm or individual with a minimum of (5) years experienced in applying coatings similar in material design, and extent to those indicated

for a particular project, whose work has resulted in applications with a record of successful in-service performance.

- C. 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. 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.
 - 4. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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 the 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 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Materials specified are those that have been evaluated for the specific service on this project. Products of the Tnemec Company, Inc. are listed to establish a standard of quality. Equivalent materials of other manufacturer's may be submitted a minimum ten days prior to bid date on written approval of the Architect. Contact: Wally Bates | wally@acconsultants.com | 610.551.3713
- B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Requests for substitution shall be submitted to the architect a minimum ten days prior to bid date in accordance with the general construction documents and in compliance with substitution procedures in Division 01 of this Project Manual.
 - 1. Requests for substitution shall include evidence of satisfactory past performance on substrates that are listed herein.
 - 2. Substitutions will not be considered that change the generic type, number of coats or do not meet specified total dry film thickness.
- C. Colors: As selected by Architect from manufacturer's full range.

2.2 HIGH PERFORMANCE EPOXY COATINGS GENERAL

- A. Materials Compatibility: Provide shop and field primers, and finish-coat materials that are single source and compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. OTC & CARB/VOC Compliance – 250-340 g/l

2.3 EPOXY PRIME COAT

- A. Tnemec Series 201 Epoxoprime
 - 1. Generic Type: Modified Polyamine Epoxy
 - 2. Properties:
 - a. Solids by Volume: 100% (mixed)
 - b. VOC: (Unthinned) 0.24 lbs/gallon (28 grams/liter)
 - 3. Performance Criteria:
 - a. Adhesion: ASTM D 7234 (Method B): Exceeds the cohesive strength of the concrete substrate (400 psi).
 - b. Abrasion: ASTM D 4060 (CS-17 Wheel, 1,000 gram load) No more than 69.5 mg loss after 1000 cycles, average three tests
 - c. Compressive Strength ASTM C 695: No less than 6,866 psi compressive strength, average of five tests.
 - d. Flexural Strength and Modulus of Elasticity ASTM D790: No less than 12,873 psi flexural strength and 553,832 psi flexural modulus of elasticity, average of three tests.

- e. Hardness: ASTM D 2240 Durometer rating 68
- f. Tensile Strength, Elongation, Modulus of Elasticity ASTM D 638. 4,871 tensile strength, average of three tests
- h. Impact ASTM 2794: 100 inch lbs (11.3J) average, direct impact
- i. Humidity ASTM D 4585. No blistering, cracking, or delamination of film after 1500 hours exposure

2.4 EPOXY BASE COAT

- A. Tnemec Series 215 Surfacing Epoxy
 - 1. Generic Type: Modified Polyamine Epoxy
 - 2. Color: 1200 White, 1212 Gray
 - 3. Properties:
 - a. Solids by Volume: 100%
 - b. Volatile Organic Compound: 0.08 lbs/gal solids (10 grams/litre)
 - 4. Performance Criteria:
 - a. Adhesion: ASTM D 7234 (Method B): Exceeds the cohesive strength of the concrete substrate (400 psi).
 - b. Compressive Strength ASTM C 579: No less than 9,183 psi compressive strength, average of five tests.
 - c. Flexural Strength and Modulus of Elasticity ASTM C 580: No less than 4,330 psi flexural strength and 324,877 psi flexural modulus of elasticity, average of six tests.
 - d. Flexural Strength and Modulus of Elasticity ASTM D790: No less than 10,630 psi flexural strength and 87,440 psi flexural modulus of elasticity, average of three tests.
 - e. Steam Pressure: No blistering, cracking, checking, gloss loss or delamination of film after 5.5 hours continuous exposure.
 - f. Tensile Strength, Elongation, Modulus of Elasticity ASTM C 307. No less than 2,280 psi tensile strength, average of six tests.
 - g. Tensile Strength, Elongation, Modulus of Elasticity ASTM D 2370. No less than 2,011 psi tensile strength, 304,213 psi tensile modulus of elasticity and 1.04% elongation average of ten tests.
 - h. Water Absorption ASTM C 413. No weight gained after 2 hours continuous boiling water immersion, average of three tests.

2.5 EPOXY COATING (Saturant and Intermediate Coat)

- A. Tnemec Series 280 Tneme-Glaze (Roller Applied)
 - 1. Generic Type: Polyamidoamine Epoxy
 - 2. Finish: Gloss
 - 3. Properties:
 - a. Solids by Volume: 100% (mixed)
 - b. VOC: 0.2 lbs/gallon (25 grams/liter)

4. Performance Criteria:

- a. Abrasion: ASTM D4060, (CS-17 Wheel, 1,000 grams load). No more than 55 mg. loss after 1,000 cycles, average of three tests.
- b. Adhesion: ASTM D 7234 Exceeds the cohesive strength of concrete substrate (400 psi) average of three tests
- c. Coefficient of Friction: ASTM D 2047. No less than 0.56 static coefficient of friction, average of three tests.
- d. Critical Radiant Flux ASTM E 648. Maximum flame propagation distance of 57 mm and critical radiant flux of 1.05 W/cm², average of three tests.
- e. Hardness: ASTM D 2240 (Shore D) Not less than Shore D hardness of 80, average of five tests
- f. Hardness: ASTM D 3363. No Gouging or scratching with an HB or less pencil.
- g. Impact: ASTM D 2794. No visible cracking or delamination after 115 in/lbs direct impact.
- h. Steam Pressure: No blistering, cracking, checking, gloss loss or delamination of film after four hours continuous exposure.
- i. Surface Burning Characteristics: ASTM E 84. No more than 15 flame spread index and no more than 155 smoke developed index (Class A)
- j. Tensile Strength, Elongation, Modulus of Elasticity ASTM D 2370. No less than 2,219 psi tensile strength, 1,238 psi tensile modulus of elasticity and 39.5% elongation average of ten tests.
- k. Water Vapor Transmission ASTM D 1653, Method B Wet Cup, Condition C. No more than 2.75 g/m² per 24 hour water vapor transmission and no more than 0.20 perms water vapor permeability, average of three tests.

2.6 CHEMICAL RESISTANT URETHANE COATING (Finish Coat)

A. Tnemec Series 297 Enviro-Glaze

1. Generic Type: Ceramic-Modified Waterborne Aliphatic Polyurethane
2. Finish: Gloss
3. Properties:
 - a. Solids by Volume: 67 +/- 2.0%
 - b. VOC 2.41 lbs/gallon (288 grams/litre)
4. Performance Criteria:
 - a. Abrasion: ASTM D4060, (CS-17 Wheel, 1,000 grams load). No more than 29 mg loss after 1,000 cycles.
 - b. Adhesion: ASTM D 7234: Exceeds cohesive strength of concrete (400 psi)
 - c. Coefficient of Friction: ASMT D 2047: No less than 0.67 static coefficient of friction average of 36 tests
 - d. Flexibility: ASTM D 522 (Method A – Conical Mandrel). No less than 43% elongation average of three tests.
 - e. Chemical Resistance No blistering, cracking or delamination of film after seven days continuous exposure to the following reagents:

Sulfuric Acid 30%	Hexane	Hydrochloric Acid 10%
Gasoline	Phosphoric Acid 50%	Ethylene Glycol
Acetic Acid 10%	Skydrol	Chromic Acid 5%
Sodium Hydroxide 10%	Transmission Fluid	Brake Fluid

	Ammonium Hydroxide	Aviation Gasoline	Sodium Hypochlorite 6%
	Jp-4 Jet Fuel	Hydrogen Peroxide 30%	
f.	Hardness: ASTM D 3363. No gouging or scratching with a 2H or less pencil.		
g.	Impact: ASTM D 2794. No visible cracking or delamination of film after 160 inch/pounds or less direct impact.		

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Surfaces shall be clean, dry and adequately protected from dampness. Surfaces shall be free of any material, which will adversely affect adhesion or appearance of painting and coating.
- B. Concrete Surfaces: Reference SSPC-SP 13/NACE 6 Surface Preparation of Concrete

3.2 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Bedding Coat: All surfaces scheduled to receive the reinforced wall system shall receive a bedding coat applied uniformly. The epoxy coating shall be mechanically mixed and applied in accordance with manufacturer's instructions. The specified fiberglass mat shall be imbedded into the wet bedding coat and smoothed to remove any air bubbles or surface imperfections.
- C. Saturant Coat: The high solids epoxy saturant coat shall be mechanically mixed in accordance with instructions and uniformly applied to all surfaces by, roller. The saturant coat shall be allowed to cure for a minimum of 8 hours, but not longer than 24 hours before application of topcoat. Before topcoating, the surface should be pole sanded to smooth surface and remove all protruding fibers. If more than 24 hours have elapsed between coats, the Stranlok ML coated surface must be mechanically abraded before topcoating.
- D. Intermediate glaze coat: The high solids epoxy glaze coat shall be mechanically mixed in accordance with manufacturer's instructions and applied by roller or airless. Small areas and areas that meet the floor, ceiling or other walls may be brushed.
- E. Topcoat: The aliphatic polyester polyurethane topcoat shall be mechanically mixed in accordance with manufacturer's instructions and applied by roller or airless spray. Small areas and areas that meet the floor, ceiling or other walls may be brushed

- F. 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.
- G. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- H. Apply coatings by roller application 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.

3.3 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.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing 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.

3.5 HIGH-PERFORMANCE COATING SCHEDULE

- A. Fiberglass Reinforced Epoxy/Urethane Wall System on Exterior Gypsum Wallboard for Interior Use:
 - 1. Prime Coat: Tnemec Series 201 Epoxoprime, applied by roller at 4.0 – 6.0 mils DFT.
 - 2. Intermediate Coat: Tnemec Series 280 Tneme-Glaze, applied at 6.0 – 8.0 mils DFT.

3. Finish Coat: Tnemec Series 297 Enviroglaze, applied at 2.0-3.0 mils DFT. Color as selected by owner.
- B. Fiberglass Reinforced Epoxy/Urethane Wall System on CMU:
1. Base Coat: Tnemec Series 215 Surfacing Epoxy applied at 25-50 sq. ft. / gal
 2. Fiberglass Mat: Series 273 Part C Stranlok ML, imbedded into the wet Epoxy Base Coat
 3. Saturation Coat: Tnemec Series 280 Tneme-Glaze, applied at a rate of approximately 150-175 sq. ft. per gallon.
 4. Intermediate Coat: Tnemec Series 280 Tneme-Glaze, applied at a rate of approximately 200-225 sq. ft. per gallon.
 5. Finish Coat: Tnemec Series 297 Enviro-Glaze, applied at 2.0-3.0 mils DFT. Color as selected by owner.

END OF SECTION 09 97 13

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New Orleans, Louisiana

SECTION 10 14 19 – DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 Section Includes

1. Element 1
2. Element 2

1.2 Scope

A. Furnish letters and hardware necessary to install cut metal letters shown on drawings and herein specified.

1.3 Submittals

- A. Manufacturer's descriptive literature and specifications.
- B. Shop Drawings
- C. Installation instructions

1.4 Quality Assurance

- A. Manufacturer to have a minimum of 10 years experience in manufacturing cut metal letters and supply references for at least three previous projects.
- B. All letters to be manufactured by one manufacturer.

Part II – Products

2.1 Acceptable Manufacturers

- A. Firm 1
- B. Firm 2

2.2 Materials

2.3 Finishes

2.4 Thickness

2.5 Font Styles

- A. Refer to drawings for letter fonts
- B. Vector art file for tree logo will be supplied by Designer for production.

2.6 Mounting Hardware

SECTION 10 14 19 – DIMENSIONAL LETTER SIGNAGE

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2.7 Fabrication

Part III – Execution

3.1 Installation

- A. A qualified installer shall install cut metal letters and tree logo.
- C. Install signs level, plumb, and at the height indicated on the drawings with sign surfaces free from distortion or other defects in appearance.

3.2 Warranty

- A. Letters should be guaranteed for life against defects (not inclusive of willful or accidental damage caused by individuals or acts of God) after approved installation.

END OF SECTION

SECTION 10 1423

PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Panel signs.
- B. Related Requirements:
 - 1. Section 14 2100 "Electric Traction Elevators" for code-required conveying equipment signage.
 - 2. Section 22 0553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 3. Section 23 0553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 4. Section 26 0553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
 - 5. Section 26 5219 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.
- B. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [Product Data](#): For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. [Product Data](#): For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".

3. **Product Data:** Laboratory test reports for signage products indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - C. **Shop Drawings:** For panel signs.
 1. Include fabrication and installation details and attachments to other work.
 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 - D. **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.
 - E. **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 Signs: Not less than 12 inches square, including corner.
 2. Exposed Accessories: Half-size Sample of each accessory type.
 - F. **Sign Schedule:** Use same designations specified or indicated on Drawings or in a sign schedule.
- 1.6 INFORMATIONAL SUBMITTALS
- A. **Qualification Data:** For Installer and manufacturer.
 - B. **Sample Warranty:** For special warranty.
- 1.7 CLOSEOUT SUBMITTALS
- A. **Maintenance Data:** For signs to include in maintenance manuals.
- 1.8 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. **Variable Component Materials:** 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
 2. **Tools:** One set(s) of specialty tools for assembling signs and replacing variable sign components.
- 1.9 QUALITY ASSURANCE
- A. **Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.
- 1.10 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.

1.11 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: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS, GENERAL

- A. Regional Materials: Panel signs shall be manufactured within 500 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- E. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 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 sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:
 - a. Materials:
 - 1) Acrylic Sheet
 - a) Thickness: 0.125 inch.
 - 2) Aluminum Sheet
 - a) Thickness: as indicated.
 - b. Surface-Applied, Flat Graphics: Applied vinyl film.
 - c. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.

- d. Translucent panel, back painted
- e. Edge Condition: Square cut.
- f. Corner Condition: as detailed.
- g. Color: Background color as selected from full manufacturer's range.
- 2. Color: As selected by Architect from manufacturer's full range.
- 3. Tactile Characters: Characters and Grade 2 Braille raised **1/32 inch (0.8 mm)** above surface with contrasting colors.
- 4. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Square.
- 5. Mounting: Manufacturer's standard method for substrates indicated with.
- 6. Text and Typeface: Accessible raised characters and Braille typeface matching Architect's sample and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
- 7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
- 8. Surface Finish and Applied Graphics:
 - a. Integral Metal Finish: Mill, brushed.

2.4 PANEL-SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.5 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.6 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a 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 connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

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. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.

2.9 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, 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 surfaces 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. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- C. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 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 2113

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Compact Laminate Solid Phenolic toilet compartments configured as toilet enclosures.
- B. Related Sections:
 - 1. Section 05 5000 "Metal Fabrications" for supports that compartments to overhead structural system.
 - 2. Section 10 2800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

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 toilet compartments.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Product Data: Laboratory test reports for ceilings, walls, acoustical and thermal insulation, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 5. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
 - 4. Show locations of centerlines of toilet fixtures.

5. Show locations of floor drains.
 6. Show ceiling grid and overhead support or bracing locations
- D. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.
- E. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each type of material, color, and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
 2. Each type of hardware and accessory.
- F. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.
- G. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Include structural design calculations indicating compliance with specified structural-performance requirements.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Product Certificates: For each type of toilet compartment, from manufacturer.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For toilet compartments 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. Door Hinges: One hinge(s) with associated fasteners.
 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 3. Door Bumper: One door bumper(s) with associated fasteners.
 4. Door Pull: One door pull(s) with associated fasteners.
 5. Fasteners: Ten fasteners of each size and type.
- 1.7 PROJECT CONDITIONS
- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.
- 1.8 WARRANTY
- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by manufacturer warranting the HDPE toilet partitions against breakage, corrosion, and delamination.
1. Warranty Period: 15 years

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- E. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- F. Additional Low-emitting requirements – Adhesives and Sealants:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Show compliance with VOC limits as detailed in Section 01 8116 "Low-Emitting Materials Restrictions".
- G. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
 - 2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.

2.2 COMPACT LAMINATE (SOLID PHENOLIC) TOILET COMPARTMENTS

- A. Basis of Design: Subject to compliance with requirements, provide Ultimate Privacy by ASI Global or a comparable product by one of the following:
 - 1. Bobrick DuraLine Series
 - 2. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - 3. Color and Pattern: model 9513 Hammered metallic bronze
- B. Design Type:
 - 1. Height.

- a. Door/Panel Height: 84 inches
 - b. Floor Clearance: 6 inches
- C. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.
- D. Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.
 - 1. Stile Height: 83 inches (211 cm).
- E. Urinal Screens:
 - 1. Basis of Design Product: Same as toilet compartment manufacturer.
 - a. Performance Criteria:
 - 1) Configurations: Floor Anchored.
 - 2) Dimensions: 24 inches deep. 72 inches high.
 - 3) Floor Clearance: 4 5/16.
- F. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.
- G. Edges: Black; brown edges not acceptable.
- H. Finished Thickness:
 - 1. Stiles and Doors: 3/4 inch (19 mm).
 - 2. Panels and Screens: 1/2 inch (13 mm).
- I. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
 - 1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - 2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- J. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).
- K. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.
- L. Hardware: .
 - 1. Hardware Series: Commercial
 - 2. Compliance: Operating force of less than 5 lb (2.25 kg).
 - 3. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - 4. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - 5. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.

6. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
7. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
8. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
 - a. Occupancy Indicator.
9. Locking: Door locked from inside by sliding door latch into keeper.
10. Hinge Type - Full-Height Institutional Hinge.
 - a. Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.
11. Mounting Brackets: Full-Height.
 - a. Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
 - b. U-Channels: Secure panels to stiles.
 - c. Angle Brackets: Secure stiles-to-walls and panels to walls.

2.3 MATERIALS

- A. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.
 1. Edges: Black; brown edges not acceptable.
- B. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 1. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.

2.4 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
 - 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 - 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 - 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Use fasteners and anchors suitable for substrate and project conditions
 - 4. Install units rigid, straight, plumb, and level.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.
- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION

SECTION 10 2600

WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
 - 2. Wall Protection.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 3. Product Data: For interior components indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
 - 4. Building Product Disclosure Requirements: To encourage the use of building products that are working to minimize their environmental and health impacts, preference will be given to products with publicly available information:
 - a. Environmental product Declarations:
 - b. Material Ingredients –Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
 - 1. Include Samples of accent strips and accessories to verify color selection.
- D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner and End-Wall Guards: 12 inches long. Include example top caps.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guard Covers: Full-size covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch-long units.
 - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Store corner-guard covers in a vertical position.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section.
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section.
 - 1. Environmental Product Declarations:
 - 2. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).

E. Low-emitting requirements – Interior Products

1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

F. Additional Low-emitting requirements – Adhesives and Sealants:

1. Do not use adhesives that contain urea formaldehyde.
2. Show compliance with VOC limits as detailed in Section 01 8116 “Low-Emitting Materials Restrictions”.

G. Sustainability Requirements:

1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alpar
 - b. Construction Specialties, Inc.
 - c. InPro Corporation (IPC).
2. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 0.0625 inch.
 - b. Finish: satin, No. 6
3. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Oval head, countersunk screws through factory-drilled mounting holes

2.4 WALL PROTECTION

- A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, PVC free plastic sheet wall-covering material.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. G2 BioBlend PVC-Free wall protection by Inpro Corp
 - b. Acrovyn PVC-free Textured sheet by Construction Specialties
2. Size: 48 by 96 inches for sheet.
3. Sheet Thickness: 0.060 inch.
4. Color: 949 White
5. Texture: Suede.
6. Height: As indicated.
7. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
8. Mounting: Adhesive.

2.5 MATERIALS

- A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- B. Adhesive: As recommended by protection product manufacturer.

2.6 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

- A. Protect 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 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 3. Run grain of directional finishes with long dimension of each piece.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 10 2800

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Toilet accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.
- B. Owner-Furnished Material:
 - 1. Paper Towel Dispensers.
 - 2. Toilet Tissue Dispensers.
 - 3. Soap Dispensers.
- C. Related Sections:
 - 1. Section 08 8300 "Mirrors" for frameless mirrors.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Sustainable Design Submittals:
 - 1. [Product Data](#): For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. [Product Data](#): Laboratory test reports for interior products indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- C. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.

- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify products using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Material:
 - 1. Paper Towel Dispensers.
 - 2. Toilet Tissue Dispensers.
 - 3. Soap Dispensers.

2.3 TOILET ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [American Specialties, Inc.](#)
2. [Bobrick Washroom Equipment, Inc.](#)
3. [Bradley Corporation.](#)
4. [GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.](#)
5. [Tubular Specialties Manufacturing, Inc.](#)

C. Grab Bar:

1. Bobrick B-5806
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length:
 - a. ADA Stall & Family Toilet Rooms: Provide rear grab bar, 36 inches min. in length extending from the wall toward the open side of the water closet at back wall; side grab bar 40- 42 inches in length beginning 12 inch max. from rear wall. All grab bars shall be between 33 to 36 inches above the finished floor.

D. Mirror Unit:

1. Basis-of-Design Product: Bradley 7B1-0024360.
2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
4. Size: As indicated on Drawings.

E. Waste Receptacle:

1. Basis-of-Design Product: Bradley B254.
2. Mounting: Freestanding.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Sanitary-Napkin Disposal Unit:

1. Basis of Design: Bobrick B-9541
2. Mounting: Surface mounted.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Hook:

1. Basis-of-Design Product: B-7672 by [Bobrick Washroom Equipment, Inc.](#)
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.5 WARM-AIR DRYERS

- A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.

- B. Warm-Air Dryer:
 - 1. Description: High-speed, warm-air hand dryer.
 - 2. **Basis-of-Design Product:** Subject to compliance with requirements, provide Bradley 2923-287401 or a comparable product by one of the following:
 - a. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.
 - 3. Mounting: Surface mounted, with low-profile design.
 - 4. Operation: Electronic-sensor activated with timed power cut-off switch.
 - a. Operation Time: 30 to 40 seconds.
 - 5. Cover Material and Finish: Steel, with white enamel finish.
 - 6. Electrical Requirements: 120 V, 12.5 A, 60Hz.

2.6 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Diaper-Changing Station:
 - 1. Basis-of-Design Product: Bradley 962-11.
 - 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support a minimum of 250-lb static load when opened.
 - 3. Mounting: Recessed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
 - 6. Liner Dispenser: Built in.

2.7 CUSTODIAL ACCESSORIES

- A. Mop and Broom Holder:
 - 1. Basis of Design: Bobrick B 224 x 36
 - 2. Description: Shelf with mop and broom holders and rag hooks.
 - 3. Length: 36 inches.
 - 4. Hooks: Three.
 - 5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
 - b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.8 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- A. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.9 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 4413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 - 2. Automated External Defibrillator Cabinets
- B. Related Requirements:
 - 1. Section 10 4416 "Fire Extinguishers."

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: Laboratory test reports for interior products indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- C. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- D. Samples: For each type of exposed finish required.
- E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets and AED cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- C. Low-emitting requirements – Interior Products
 - 1. General Emissions Evaluation: Interior products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.
- D. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Product – Recessed cabinet: Subject to compliance with requirements, provide Larsen's model #0-2409 or comparable product by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Potter Roemer LLC.
 - 2. Basis of Design Product – Semi-Recessed and surface mounted cabinet: Subject to compliance with requirements, provide Larsen's model #2409 – Architectural Series or comparable product by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Potter Roemer LLC.
- B. Cabinet Construction: UL listed with fire resistance rating of hall where it is installed.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.

- D. Recessed Cabinet:
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: Same material and finish as door.
- H. Door Material: Steel sheet.
- I. Door Style:
 - 1. Recessed Cabinet: Vertical duo panel with frame.
 - 2. Semi-Recessed Cabinet: Solid opaque panel with frame.
 - 3. Surface Mounted Cabinet: Solid opaque panel with frame.
- J. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Door Lock: Cylinder lock, keyed alike to other cabinets.
 - 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
 - 5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
 - 6. Manufactures projecting wall mounted sign, indicating 'FIRE EXTINGUISHER'.
 - 1) Application Process: Pressure-sensitive vinyl letters.
 - 2) Lettering Color: Red.
 - 3) Orientation: Vertical.
 - b. Provide Manufacturer's Standard factory installed identification for AED Cabinets
- M. Materials:
 - 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

- a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - a. Finish: Color anodic.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
3. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/A480M No. 4 directional satin finish,.
4. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), with Finish 1 (smooth or polished).

2.4 AUTOMATED DEFIBRILLATOR CABINET

- A. Cabinet, Non-Rated: Cabinet box constructed of cold-rolled steel with baked enamel finish and tempered float glass door viewing window.
 1. Basis of Design: Heartstation 5300- Semi Recessed Defibrillator Cabinet. RC5300RB or a comparable product by one of the following:
 - a. Larsen's Manufacturing Company.
 - b. Potter Roemer LLC
 - c. J.L. Industries, Inc., a division of Activar Construction Products Group
 2. Cabinet Rough-in Size: Not to exceed 14"H x 14"W x 7"D, as required to incorporate AED and specified features. All cabinet components and equipment shall be accessible, removable and replaceable with the cabinet door in a 90 degree position.
 - a. Provide compact cabinets where indicated
 3. Cabinet Door and Trim Material: Manufacturer's standard steel sheet
 4. Door Style: Tempered Float Glass with frame of material and finish to match box and trim
- B. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type and door material and style indicated, and as follows:
 1. Provide Recessed handle as required with mounting type to maintain ADA minimum projection clearances

2.5 AUTOMATED EXTERNAL DEFIBRILLATORS

- A. AED manufactured by Philips, model #861304 HeartStart FRx Defibrillator with the following options and accessories; model #OptR01 HeartStart FRX ready- Pack, model #989803139311 Infant/ Child Key, model #68-PCHAT Fast Response Kit.

2.6 FABRICATION

- A. Fire Protection and AED Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection and AED Cabinets: Fasten cabinets to structure, square and plumb.
 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 4416
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Owner-Furnished Material: Hand-carried fire extinguishers.
- C. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amerex Corporation](#).
 - b. [JL Industries, Inc.; a division of the Activar Construction Products Group](#).
 - c. [Kidde Residential and Commercial Division](#); Subsidiary of Kidde plc.
 - d. [Larsens Manufacturing Company](#).
 - e. [Potter Roemer LLC](#).
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amerex Corporation](#).
 - b. [JL Industries, Inc.; a division of the Activar Construction Products Group](#).
 - c. [Larsens Manufacturing Company](#).
 - d. [Potter Roemer LLC](#).
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 10 66 00

WOVEN MESH STRUCTURES AND RIGGING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Komodo Mesh Enclosure
- B. Work Furnished but Installed under Other Sections.
 - 1. Furnish structural steel columns, beams, etc., as indicated in the Construction Documents.
 - 2. Furnish steel rods, plates, and other misc. steel sections required for a complete, and fully functional system, as indicated in Construction Documents.
- C. Related Sections:
 - 1. Division 01 Section "Animal Management Requirements of Construction:" Construction coordination requirements for animal management.
 - 2. Division 05 Section "Animal Caging and Rigid Panel Systems."

1.3 SUBMITTALS

- A. Submittals: Submit Shop Drawings, Product Data, and Samples to the requirements of Section 013300.
- B. Mesh Structure Shop drawings: Indicate layout, location, and all dimensions for the mesh structure. Show all concrete details, steel reinforcing, and steel erection details, connection details, and all miscellaneous steel fabrication details.
- C. Mesh Fabric Shop Drawings: Show all plans, elevations, cross-sections, and complete details of all anchoring methods, fastenings, mesh attachment methods, operable panel details, materials and methods for a complete installation for all structures.
- D. Product Data: Provide manufacturer's engineering data and other pertinent product data for hand woven steel netting/mesh, wire rope, and all hardware (turnbuckles, clevis sockets, hinges, latches, locks, etc.)
- E. Samples:
 - 1. Hand-Woven Mesh - 18" x 18" samples of mesh specified.
 - 2. Turnbuckles with 12" long piece of specified cable/wire rope attached to indicate connection.

3. All end fittings with 12" long piece of specified cable/wire rope attached to indicate connection.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Structural Requirements: Provide steel wire rope assemblies for the size and type of wire rope shown on the construction documents:
 1. Wire rope assemblies must maintain minimum sag requirements shown on construction documents. Sags greater than those shown on documents are permitted upon approval of Architect & Engineer. Wire ropes labeled as Guy Wires to be tensioned as indicated by structural drawings.
 2. Components: ultimate or breaking load strength must exceed breaking load strength of attached wire rope.
 3. Substitutions: Wire ropes and assemblies of equal or greater breaking strength than the wire rope assemblies shown on construction documents may be substituted upon approval of Engineer of Record.
- B. Wire rope assemblies shall be designed, fabricated, and installed to accommodate expansion and contraction of metal components without causing undue stress, buckling, opening of joints, and distortion. Design for the following minimum temperature ranges.
 1. Ambient Temperature Range: -20 to 120 degrees F (67 degrees C).
 2. Material Surface Temperature Range: -20 to 180 degrees F (100 degrees C).
- C. Design system to prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 QUALITY ASSURANCE MESH AND RIGGING INSTALLERS

- A. Experience and Qualification of Bidders: The subcontractor, in order to qualify as a specially skilled craftsman for installation of this work, shall demonstrate a minimum of ten (10) years experience in metal work of this type, plus a minimum of three (3) similar projects involving containment of animals. Companies requesting consideration shall submit written and photographic proof of previously performed projects and resumes of lead construction crew personnel to be used on this project. The site supervisor's resume should show a minimum of three similar projects.

1.6 FIELD MEASUREMENTS

- A. Prior to submission of shop drawings, the Specialty Mesh Contractor shall verify that all field measurements are as indicated on the Mesh Structure Drawings and Schedules, and notify the Architect in writing of any major discrepancies. No fabrication shall proceed until all inconsistencies are corrected.

1.7 Mock-Ups: Provide mock-ups for evaluation of preparation techniques and installation workmanship. Provide one mock-up for each barrier/fence system.

- A. Locate in areas designated by Architect.
- B. Size: Minimum of 100 SF and including typical wire rope hardware connections and wire netting/mesh.

- C. Do not proceed with remaining work until workmanship is approved by Architect.
- D. Rework mock-up as required to produce acceptable work.
- E. Retain mock-up during construction as quality standard.
- F. Remove and legally dispose of mock-up when no longer needed or incorporate final approved mock-up into final construction.

PART 2 - PRODUCTS

2.1 MATERIALS FOR MESH STRUCTURES

- A. Concrete: Type specified in Division 03 Section "Cast-in-Place Concrete" to the requirements of the Structural Drawings.
- B. Structural Steel: Type specified by the requirements of the Structural Drawings and in Division 05 Section "Structural Steel," and the following:
 - 1. Finish:
 - a. Galvanized surface to be prepared per ASTM D6386 in locations indicated to receive painted finish.
 - b. Field painted in locations indicated on the drawings to the requirements of Division 09 Section "High Performance Coatings."
- C. Miscellaneous Steel: Type specified in Division 5 – Section "Metal Fabrications" and to the requirements of the Structural Drawings. Miscellaneous steel items shall include but is not limited to the following:
 - 1. Continuous steel rods in diameter indicated on drawings, welded to steel studs that are welded to the structural steel at 24" O.C. max or as indicated for the purpose of attaching all steel mesh fabrics. Provide 3/4" gap max or as indicated between rods and substrates for lacing the mesh fabric.
 - 2. All other miscellaneous steel fabrications required for the complete and fully functional mesh structures system.
 - 3. Finish: Provide the following finishes on all miscellaneous steel items as indicated on drawings:
 - a. Hot Dipped Galvanized. Galvanized surface to be prepared per ASTM D6386 in locations indicated to receive painted finish.
 - b. Field painted in locations indicated on the drawings to the requirements of Division 09 Section "High Performance Coatings."
- D. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.2 MATERIALS FOR STAINLESS STEEL WOVEN NETTING/MESH

- A. Steel Mesh Types: Stainless steel type mesh, and as indicated on the Drawings, as follows:
 - 1. Hand-woven netting:
 - a. Opening Size: As noted on drawings.

- b. Material: Type 302/304 stainless steel cable, diameter as noted on drawings, made from 7 x 7 strand with double half hitches at every joint.
- c. Finish: Stainless Steel
- d. Product/Suppliers:
 - 1) Containment Systems Inc. 205-533-7040. (Attn: Tom Pankey)
 - 2) Otto Environmental, Greenfield, WI. www.ottoenvironmental.com, Attn: Iryna Lebedyeva, PhD. (414) 529-7780.
 - 3) Or approved equal.

2.3 MATERIALS FOR RIGGING

- A. Provide types and sizes as required for wire rope sizes indicated on the Drawings, including, but not limited to the following:
 - 1. Wire Rope Cables – 6x19 (EIPS) aircraft cable. All buried cables, or cables within 3" above grade to be type 302/304 stainless steel. All other cables to be galvanized. Manufactured by Leschen, USS Tiger Brand, Hackensack, Kulkoni, or approved equal.
 - 2. Turnbuckles – Sizes indicated on drawings, hot-dipped galvanized forged construction. Rated for minimum of 100% breaking strength of associated wire rope. Basis of Design:
 - a. Crosby Group, Tulsa, Oklahoma, www.thecrosbygroup.com.
 - b. Electroline Industrial Turnbuckles - <https://www.electrolineusa.com/industrial/wire-rope-fittings/>
 - c. Or approved equal.
 - 3. Cable End Fittings – Sized to fit wire ropes shown on drawings, or as indicated on drawings. Hot-dipped galvanized forged construction. Rated for minimum of 100% breaking strength of associated wire rope.
 - 4. Other Misc. Hardware – Shackles, links, eyebolts, etc, sized to fit wire ropes and connections shown on drawings, or as indicated on drawings. Stainless steel or Hot-dipped galvanized forged construction to match attached wire rope material. All hardware must develop the full capacity of the wire rope.

PART 3 - EXECUTION

3.1 INSTALLATION OF STRUCTURAL WORK

- A. Install, erect, and tension all required structural work to the criteria of the Structural Drawings.

3.2 INSTALLATION OF HAND-WOVEN STEEL MESH

- A. Prior to installing any mesh, verify that all necessary structural work is finished and in place ready to receive Work. Do not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.
- B. Install all work in accordance with approved shop drawings.
- C. All loose ends of cables and mesh shall be finished with a double 'NICO' press crimp, and ground smooth. No loose cable ends or sharp edges will be permitted.

3.3 TOUCH UP PAINTING

- A. Immediately after erection, clean field welds, bolted connections, and abraided areas of shop paint. Apply paint to exposed areas with same materials used for shop priming.
- B. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

END OF SECTION 10 66 00

SECTION 12 4813

ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Entrance Floor Mats.

1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: Laboratory tests for flooring products, indicating compliance with requirements for low-emitting materials listed in Section 01 8116 "Low-Emitting Materials Restrictions".
- C. Shop Drawings:
 - 1. Items penetrating floor mats, including door control devices.
 - 2. Divisions between mat sections.
 - 3. Perimeter floor moldings.
- D. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: Assembled sections of floor mat.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats 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. Resilient-Tile Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS, GENERAL

- A. Structural Performance: Provide roll-up rail mats capable of withstanding the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform floor load of 300 lbf/sq. ft..
 - 2. Wheel load of 350 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.
- C. Sustainability Performance Requirements: For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's performance criteria as outlined in the following Section:
 - 1. 01 8113 "Sustainable Design Requirements".
 - 2. 01 8116 "Low Emitting Materials Restrictions".
- D. Additional Low-emitting requirements – Flooring:
 - 1. Carpet and cushion shall comply with testing and product requirements of CRI's "Green Label Plus" testing program.
- E. Additional Low-emitting requirements – Flooring:
 - 1. FloorScore Compliance: Hard Surface flooring and Adhesives shall comply with requirements of FloorScore Standard.
- F. Sustainability Requirements:
 - 1. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.

2.2 RESILIENT ENTRANCE MATS

- A. Cocoa Mats: Constructed from cocoa fiber yarn permanently bonded to PVC backing for dimensional stability and resistance to shedding; 5/8- to 3/4-inch overall thickness; 1.5-lb/sq. ft. weight.
 - 1. Basis of Design: Matter, New York Collection
 - 2. Thickness: 3/8 inch.
 - 3. Color: Brown Sugar.
 - 4. Mat Size: Custom size as indicated.

2.3 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

END OF SECTION

DRAFT Construction Specification
50% Design Development
Audubon Zoo Odenheimer Building
New Orleans, Louisiana

SECTION 13 60 20 – EXHIBIT MODELS & FOSSILS - EXHIBITS

PART 1 GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The Contract Forms, Conditions of the Contract and General Requirements, apply to the work under this Section.
- B. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 SCOPE OF WORK

- A. The work of this Contract consists of furnishing life-like and accurately depicted models of wildlife, fossils, and habitat materials, surrounds and interactive components as described herein.
- B. Model sculptures and fossils are required for the following elements:
 - 1. Posed full body adult *Tyrannosaurus rex* fossil replica (“Stan” specimen or other)
 - 2. Full sized adult *Tyrannosaurus rex* leg bones
 - 3. Full sized adult elephant leg bones
 - 4. Full sized adult ostrich leg bones
 - 5. “Berlin” specimen of *Archaeopteryx* fossil replica
 - 6. Triceratops skin fossil replica
 - 7. *T. rex* skin fossil replica
 - 8. Coprolite fossil replica
 - 9. “Sue” *T. rex* arm fossil replica
 - 10. Variety of late Cretaceous plant & animal fossils or fossil replicas, including bark, leaves, bone fragments, etc.
 - 11. Half scale adult *T. rex* head skull and skinned head for Pepper’s Ghost interactive
 - 12. Various ‘underground’ fossils (touchable)
 - 13. *T. rex* brain endocast
 - 14. Human brain
 - 15. Baboon brain
 - 16. Alligator brain
 - 17. Parrot brain
 - 18. *T. rex* eyeball
 - 19. *T. rex* tooth (touchable)
 - 20. *T. rex* nest & eggs

1.02 SUBMITTALS

- A. Submit the following for approval by Designer:

SECTION 13 60 20 EXHIBIT MODELS & FOSSILS - EXHIBITS

DRAFT Construction Specification
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New Orleans, Louisiana

1. Drawings depicting each exhibit with sizes, orientation and special conditions noted.
2. Clay maquettes for each sculpted element to ensure correct appearance and details are achieved to Designer's approval before final casting. Detailed photographs (from at least 8 angles) of these maquettes in progress should be submitted to Designer for feedback on shape, scale and detail. Photos of final clay maquette will be reviewed and approved by Designer for Exhibit Fabricator to proceed with casting final models. Approval of each maquette must occur prior to casting final models.
3. Mechanism drawings for operable components.
4. Final cast and painted models for review and approval.
5. Fossil replicas to be purchased, prior to purchase

1.03 QUALITY ASSURANCE

A. Qualifications of Model Fabricator:

1. Pre-qualified Model Fabricators:
 - a. FIRM 1
 - b. FIRM 2
2. The Model Fabricator shall have been in business for a minimum of five (5) years and indicate in detail an experience with life-like and three-dimensional natural history representations.
3. The Model Fabricator shall have a demonstrated ability to reproduce fossil specimens
4. The Model Fabricator, if not listed above, shall submit a photographic portfolio as references of experience. These materials will be used to evaluate the ability to perform the work.

1.04 MODELS

- A. All animal and botanical models are intended to be realistic, life-like, life-sized (or as described if shrunk or enlarged) and painted are to appear accurately depicted to the trained eye.
- B. Where fossil replicas are indicated, they shall:
 1. Be of museum quality
 2. Be produced from casts of extant fossils or suitably high fidelity digital scans of extant fossils.

SECTION 13 60 20 EXHIBIT MODELS & FOSSILS - EXHIBITS

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- a. Fossil replicas that are not from casts or scans of extant fossils shall not be produced without prior written approval from the owner.

Certain objects are identified to be available for the public to touch and, therefore, must “bear the traffic” and withstand continual and vigorous handling without wear.

- C. If actual fossils (not replicas) are found by the Model Fabricator to be available for purchase, they shall:
 - 1. Have a certifiable chain of custody and ownership;
 - 2. Not have been found, excavated, acquired, or sold through illegal, unethical, or unknown means; and
 - 3. Not be purchased without prior written approval from the Owner.
- D. Where mounting is required, all integral devices are to be provided as a part of this Work. All mounting elements are to be concealed.
 - 1. Fossil mounting shall utilize discreet metal armatures, per standard museum practice.

1.05 MODEL DESCRIPTIONS

- A. Model descriptions are included as part of the Exhibit Design Package.

END OF SECTION

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Audubon Zoo Odenheimer Building

New Orleans, Louisiana

SECTION 12 80 00 – PLANT REPLICATION AND PRESERVATION

PART 1 GENERAL

1.01 SUMMARY

- A. For 3.2 Roots and Branches Tree Sculpture. Provide replicated and or preserved plant materials which, after processing, require no water and exhibit no deterioration and are insect-resistant.
- B. Include all costs related to obtainment of plant specimens in the field, preservation methods, and delivery to site for installation by landform installer.

1.02 SUBMITTALS

- A. Submit complete list of plants to be processed, including species, height, caliper, and relevant characteristics.
- B. Submit maintenance instructions for preserved plants.
- C. Submit a sample of preserved, replicated plants for each habitat, including plug and a written description of the proposed method for removing items for refurbishment by Owner. See Special Surfaces Section.

SECTION 50 13 60 40 PLANT REPLICATION & PRESERVATION

DRAFT Construction Specification

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1.03 QUALITY ASSURANCE

- A. Plant Appearance: Plants shall be processed for 'best appearance.' Best appearance is defined as plants which, after processing, appear with natural color and foliage, with minimum of 80 percent of their original leaves and unchanged bark appearance. Crushed or deformed plants will not be acceptable.
- B. Plant Materials: The company which provides plant processing services shall coordinate with the Owner and bear the cost for the handling and packaging necessary to properly transport plant materials to and from site.
- C. Labeling: Label at least one specimen of each type with waterproof tag showing botanical and common name.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store and handle materials in strict compliance with processor's instructions and recommendations. Protect all materials from damage, injury and theft.

1.05. WARRANTY

- A. Provide a one year warranty that plants will remain as provided without deterioration. Any plant materials which exhibits signs of deterioration shall be removed from the site and replaced at no additional cost to the Owner.

SECTION 50 13 60 40 PLANT REPLICATION & PRESERVATION

Exhibit Specifications

PART 2 PRODUCTS

2.01 PLANT MATERIALS

- A. Plant materials will be identified by the Owner. Plants for preservation/replication will be taken by the Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install preserved plants after work areas are cleaned of all construction debris, when all construction overhead or within the immediate area has been completed, when building and HVAC systems are fully balanced and operable, and when all lighting systems are fully active. Beginning work means Installer accepts conditions.
- B. Provide plant materials to landform installer for installation.

3.02 CLEANING AND PROTECTION

- A. Provide temporary measures of protection to ensure work being without damage or deterioration at time of final acceptance.

3.03 SCHEDULE

PLANT REPLICATION AND PRESERVATION

Exhibit Specifications

END OF SECTION

PLANT REPLICATION AND PRESERVATION

DRAFT Construction Specification
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SECTION 13 60 20 – EXHIBIT MODELS & FOSSILS - EXHIBITS

PART 1 GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

- A. The Contract Forms, Conditions of the Contract and General Requirements, apply to the work under this Section.
- B. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 SCOPE OF WORK

- A. The work of this Contract consists of furnishing life-like and accurately depicted models of wildlife, fossils, and habitat materials, surrounds and interactive components as described herein.
- B. Model sculptures and fossils are required for the following elements:
 - 1. Posed full body adult *Tyrannosaurus rex* fossil replica (“Stan” specimen or other)
 - 2. Full sized adult *Tyrannosaurus rex* leg bones
 - 3. Full sized adult elephant leg bones
 - 4. Full sized adult ostrich leg bones
 - 5. “Berlin” specimen of *Archaeopteryx* fossil replica
 - 6. Triceratops skin fossil replica
 - 7. *T. rex* skin fossil replica
 - 8. Coprolite fossil replica
 - 9. “Sue” *T. rex* arm fossil replica
 - 10. Variety of late Cretaceous plant & animal fossils or fossil replicas, including bark, leaves, bone fragments, etc.
 - 11. Half scale adult *T. rex* head skull and skinned head for Pepper’s Ghost interactive
 - 12. Various ‘underground’ fossils (touchable)
 - 13. *T. rex* brain endocast
 - 14. Human brain
 - 15. Baboon brain
 - 16. Alligator brain
 - 17. Parrot brain
 - 18. *T. rex* eyeball
 - 19. *T. rex* tooth (touchable)
 - 20. *T. rex* nest & eggs

1.02 SUBMITTALS

- A. Submit the following for approval by Designer:

SECTION 13 60 20 EXHIBIT MODELS & FOSSILS - EXHIBITS

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1. Drawings depicting each exhibit with sizes, orientation and special conditions noted.
2. Clay maquettes for each sculpted element to ensure correct appearance and details are achieved to Designer's approval before final casting. Detailed photographs (from at least 8 angles) of these maquettes in progress should be submitted to Designer for feedback on shape, scale and detail. Photos of final clay maquette will be reviewed and approved by Designer for Exhibit Fabricator to proceed with casting final models. Approval of each maquette must occur prior to casting final models.
3. Mechanism drawings for operable components.
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1. Pre-qualified Model Fabricators:
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3. The Model Fabricator shall have a demonstrated ability to reproduce fossil specimens
4. The Model Fabricator, if not listed above, shall submit a photographic portfolio as references of experience. These materials will be used to evaluate the ability to perform the work.

1.04 MODELS

- A. All animal and botanical models are intended to be realistic, life-like, life-sized (or as described if shrunk or enlarged) and painted are to appear accurately depicted to the trained eye.
- B. Where fossil replicas are indicated, they shall:
 1. Be of museum quality
 2. Be produced from casts of extant fossils or suitably high fidelity digital scans of extant fossils.

SECTION 13 60 20 EXHIBIT MODELS & FOSSILS - EXHIBITS

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- a. Fossil replicas that are not from casts or scans of extant fossils shall not be produced without prior written approval from the owner.

Certain objects are identified to be available for the public to touch and, therefore, must “bear the traffic” and withstand continual and vigorous handling without wear.

- C. If actual fossils (not replicas) are found by the Model Fabricator to be available for purchase, they shall:
 - 1. Have a certifiable chain of custody and ownership;
 - 2. Not have been found, excavated, acquired, or sold through illegal, unethical, or unknown means; and
 - 3. Not be purchased without prior written approval from the Owner.
- D. Where mounting is required, all integral devices are to be provided as a part of this Work. All mounting elements are to be concealed.
 - 1. Fossil mounting shall utilize discreet metal armatures, per standard museum practice.

1.05 MODEL DESCRIPTIONS

- A. Model descriptions are included as part of the Exhibit Design Package.

END OF SECTION

SECTION 22.01.00
PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.02 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.01 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.01 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.

- 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.

- l. Charts of valve tag number, with location and function of each valve.
- m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
- n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 22.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.
10. Provide gas piping pressure test reports.

END OF SECTION 22.01.00

SECTION 22.05.00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.02 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.03 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.04 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.05 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's seal, name, address and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 - 6. Indicate exact location of all underground plumbing and flow line elevation.
 - 7. Indicate exact location of all underground plumbing piping and elevation.
 - 8. Indicate exact location of all underground electrical raceways and elevations.
 - 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 - 11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
 - 12. Exact location of all electrical equipment in and outside of the building.
 - 13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 - 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 15. Cloud all changes.

1.07 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.08 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.09 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no

additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.02 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.03 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.04 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of _____ hours dedicated instructor time.
 - 2. _____ hours on each of _____ days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).

- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.05 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.06 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.07 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION 22.05.00

SECTION 22.05.10
PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.02 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.03 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.04 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.05 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.06 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.

5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.01 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.01 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION 22.05.10

SECTION 22.05.12
PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1.** Distribution as specified
 - 2.** Inclusion in the Operating and Maintenance Manual, as specified, in the related section
- D. Shop Drawings: Drawings, schedules, and other data prepared by the Contractor or its suppliers to illustrate how specific portions of the work will be fabricated and installed.

1.02 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- E. Electronic shop drawing submittals are required.
- F. Shop drawings must include all domestic water supply piping, equipment and all sanitary sewer and vent piping systems shown on the Contract Drawings.

1.03 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4" = 1'-0".

- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.04 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply," "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.05 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.06 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.07 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.08 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.09 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION 22.05.12

SECTION 22.05.13
ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for plumbing equipment.
 - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.
- D. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.
- E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.02 RELATED WORK

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

1.03 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.04 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.01 MOTORS

- A. Provide motors for plumbing equipment manufactured by one of the following:
 - 1. Baldor Electric Company.
 - 2. Century Electric Div., Inc.
 - 3. General Electric Co.
 - 4. Louis Allis Div.; Litton Industrial Products, Inc.
 - 5. Lincoln Electric
 - 6. Marathon Electric Mfg. Corp.
 - 7. Reliance Electric Co.
 - 8. Westinghouse Electric Corp.
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
 - 1. Frames. NEMA #56.
 - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded

drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.

4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.02 EQUIPMENT FABRICATION

- A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION 22.05.13

SECTION 22.05.14
PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.02 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.03 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.02 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.03 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.

- C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.
- G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.
- H. Relocate all domestic piping as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities that do not provide service to the buildings that remain.
- K. Remove existing plumbing vent penetrations through roof not to be reused.

3.04 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.
- H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.05 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.06 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION 22.05.14

SECTION 22.05.17
PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.01 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Prime coat finish
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- G. Material suitable for wall and/or ceiling mounting

2.02 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.03 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 24" x 24" for plumbing multiple isolation valves and electrical related items in ceilings
 - 2. 8"x8" for plumbing for single isolation valve or shock arrestor

END OF SECTION 22.05.17

SECTION 22.05.33
PIPE HEAT TRACING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.02 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 22 05 12.
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.02 COMPONENTS

- A. Self-regulating heater.
 - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
 - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.

4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
6. Power connection, end seal, splice and tee kits components shall be applied in the field.
7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.
- C. Apply "Electrically Traced" signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

3.02 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
 1. Wiring of control instruments between thermostat and junction boxes
 2. Installation of thermostat and junction boxes
 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.

- G. Make all joints and connections with approved mechanical connectors.

3.03 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
 - 1. Simulate freezing outside air conditions
 - 2. Measure the amperage draw of the heat tracing system
 - 3. Compare to the manufacturer's capacity rating of the actual system
 - 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.
- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END OF SECTION 22.05.33

SECTION 22.07.19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.
- B. Furnish and install plenum wrap insulation over PVC vent piping.

1.02 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.03 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work.

Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
 - 1. Johns-Manville Micro-Lok AP-T
 - 2. Owens-Corning ASJ/SSL
 - 3. Knauf ASJ/SSL
- B. Aluminum Jacketing:
 - 1. Childers
 - 2. Pabco
 - 3. RPR
- C. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Vimasco
- D. Mastics and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armstrong 520 Adhesive
- E. Elastomeric Insulation
 - 1. Armacell
- F. Fire Barrier Plenum Wrap Insulation
 - 1. Totally encapsulated with foil facing
 - 2. Single layer fire protection
 - 3. Plenum Protection System UL910
 - 4. Acceptable Manufacturers:
 - a. FyreWrap 0.5 Plenum Insulation
 - b. 3M Fire Barrier Plenum Wrap 5A

2.02 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in

thickness as shown.

1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.03 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or
- B. d
- C. rip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.
 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.04 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 adhesive.
- B. Vapor Barrier Finish:
 1. Indoors: Provide as insulation coating Childers CP-35, white.
 2. Outdoors: Provide as insulation coating Childers Encacel X.
 3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- D. Lagging Adhesive. Provide Childers CP-50.
- E. Other products of equal quality will be acceptable only upon approval.

2.05 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.06 FIRE BARRIER PLENUM WRAP

- A. High temperature insulation blanket specifically designed to provide a single layer, flexible enclosure around combustible items located within fire rated return air plenums.

PART 3 - EXECUTION

3.01 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & 3/4" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- F. Piping to be insulated as specified above:
 - 1. All hot and cold water.
 - 2. Cold water within 5 feet of exterior walls.
 - 3. Make-up water
 - 4. Above Grade: Horizontal sanitary drain piping that receives condensate
 - 5. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down

3.02 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
- D. Apply a tack coat of fitting mastic over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.03 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.

C. Install straps on 9" centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.04 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.

B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.

D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.05 MISCELLANEOUS

A. Install materials after piping has been tested and approved.

B. Apply insulation on clean, dry surfaces only.

C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

D. Install plenum wrap material with bands as specified at PVC vent piping as required.

3.06 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1/2
Horizontal Sanitary Drain Piping Which Receives Condensate	1/2
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1/2
Domestic Hot Water Piping, 2" Pipe and Larger	1/2
PVC Vent Piping	1/2

END OF SECTION 22.07.19

SECTION 22.11.16
DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.02 RELATED WORK

- A. Division 22 Plumbing
1. Valves, Strainers and Vents
 2. Pipe and Pipe Fittings - General
 3. Plumbing Piping Insulation
 4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.01 PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries:
1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
 2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a "bending" temper tubing.
 3. 4-inch and larger, provide ductile iron pipe with mechanical joints, ANSI A21.6.
- C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- F. 2" Pipe and Smaller:
1. Vic-Press 316™: ASTM A-312 stainless steel housings with ASTM A-276 and A-312 outlets and stainless steel plain or grooved ends, type 316, complete with synthetic rubber Grade "H" (HNBR) seals rated for applicable services to +210

Deg F (+98 Deg C); Grade "E" EPDM for applicable services to +250 Deg F (+120 Deg C); or Grade "O" Fluoroelastomer for applicable services to +300 Deg F (+149 Deg C). System shall be rated to 500 psi (3447 kPa) unless noted otherwise.

- a. Flange Adapters: ANSI Class 150 flange adapter, Van Stone type with stainless steel back-up flange and Vic-Press™ ends. Rated for services to 275 psi (1876 kPa). Victaulic Style P566.
 - b. Unions: Threaded union, 316/316L stainless steel, with Vic-Press™ ends Victaulic Style P585.
 - c. Vic-Press with HNBR or EPDM seals shall be ANSI/NSF 61 Annex G Certified for Potable Water.
 - d. Vic-Press System shall be FM approved for fire protection services.
- G. 2-1/2" to 4" Pipe Size:
1. Couplings shall be Installation-Ready, for direct stab installation without field disassembly, with Nitrile grade T gasket rated +180 deg F for compressed air with oil vapors. Victaulic Style 107H (rigid) or Style 177 (flexible). Where required coupling housing galvanized coating may be used.
 2. Roll groove stainless steel pipe with Victaulic grooving tools equipped with RX roll sets, specifically designed for stainless steel pipe.
 3. A factory trained field representative (direct employee) shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. The coupling manufacturer's representative shall periodically visit the job site and review installation. Contractor shall remove and replace any joints deemed improperly installed.
 4. All grooved joint coupling, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

2.02 WATER HAMMER ARRESTORS

- A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard P

2.03 I WH-201; refer to schedule on drawings.

- A. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.
- B. All water hammer arrestors shall be installed in a vertical position.
- C. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.01 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.02 STERILIZATION

- A. Sterilize the water system with solution containing not less than 50PPM available chlorine. Allow chlorinating solution to remain in system for period of 8 hours (minimum). Have valves and faucets opened and closed several times during the period. After sterilization, flush the solution from the system with clean water until residual chlorine content is less than 0.2 parts per million.

3.03 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

- A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.04 TESTING

- A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
- C. Use only potable water for the test.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.05 COPPER PIPE CORROSION PROTECTION

- A. Corrosion protect copper tube piping systems:

1. In the building slab.
 2. Beneath the building slab.
 3. Buried.
 4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.
- B. Cover copper tubing piping system with:
1. "Tapecoat" TC Primer.
 2. "Tapecoat" CT cold applied coating tape.
- C. Install coating system as specified by the manufacturer.
- D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.06 TEST OF PIPE CORROSION PROTECTION SYSTEM

- A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
- B. Make repairs to small holes in accordance with the manufacturer's instructions.
- C. Retest the repairs using the procedures listed above.
- D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION 22.11.16

SECTION 22.11.23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.02 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

- A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.03 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.04 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump.

Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.05 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.01 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

- A. Pump Construction:
 - 1. Wet-rotor, in-line, single stage
 - 2. Bronze housings with ½" and ¾" sweat connections
 - 3. Stainless steel housing with union threaded connections
 - 4. Integrated check valve inside union fitting on a sweat pump housing
 - 5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
 - 6. Built-in timer
 - 7. Aquastat thermostatic control

2.02 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

- A. Pump Construction:
 - 1. Hermetically sealed motor
 - 2. Positive action air operated diaphragm switch
 - a. High water alarm contact
 - 3. Housing and base cast iron construction
- B. Provide an alarm terminal cabinet.
 - 1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm".
- C. Test the sump pump package by operation of the completed system through four cycles of operation.
 - 1. Fill the sump to operational levels
 - 2. Visually check level controls
 - 3. Pump operation
 - 4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
 - 5. Verify alarms
 - 6. Verify pump capacity
- D. Sump pump package capacity shall be as scheduled.

- E. Acceptable Manufacturers:
 - 1. Hydromatic
 - 2. Little Giant Pump Co.
 - 3. Weil
 - 4. Goulds
 - 5. Grundfos
 - 6. Crane (Barnes) Air Pumps
 - 7. Ebara

2.03 FLOW INDICATOR

- A. Flow Indicator
 - 1. Bronze Construction
 - 2. Rotating wheel
 - 3. Line Size
 - 4. Double Window
 - 5. Ernst Flow Industries Model EFI E-57-3

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 - 1. Provide access space around pumps for service.
 - 2. Lubricate pumps prior to start-up.
 - 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
 - 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 - 2. Are non-overloading in parallel and individual operation.
 - 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.02 ALIGNMENT FOR BASE MOUNTED PUMPS

- A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.
- B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
- C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.03 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
 - 1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
 - 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 - 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 - 3. Submit readings for approval.
 - 4. Include the approved readings in the Owner's Maintenance Manual.

3.04 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
 - 1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 - 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
 - 1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.05 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
 - 1. A mechanical seal for each pump
 - 2. A set of bearings for each pump

END OF SECTION 22.11.23

SECTION 22.11.24
DOMESTIC WATER BOOSTER PUMP PACKAGE
(Close-Coupled End Suction)

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Furnish and install a constant pressure booster system. The entire system shall be factory assembled and tested.

1.02 RELATED WORK

- A. Division 23 - Mechanical

1.03 QUALITY ASSURANCE

- A. The packaged pumping module manufacturer shall have a quality assurance program to assure the quality of all materials furnished. The packaged pumping module manufacturer shall have a certified and sealed welding procedures manual in place. All welders must be certified for MIG, TIG and STICK welding.
- B. The control panel shall be constructed to NEMA standards and shall be UL 508 listed. The UL-508 label with its serial number shall be attached to the inside of the control panel door.
- C. The module manufacturer shall have a minimum of 15 years manufacturing and application experience and be responsible for the proper flow and pressure performance of the entire pumping system.
- D. The complete packaged pumping module shall be hydrostatically tested for a minimum time of two hours. The hydrostatic tests shall be at a minimum of 150 psig or 50 psig greater than the system design pressure when the system design pressure is greater than 100 psig. If any leaks are found, they shall be repaired and the hydrostatic test shall be repeated for a duration of two hours.
- E. The control system shall be tested for proper sequence of all systems and the alarms shall be simulated during the sequencing test.
- F. The packaged pump module manufacturer shall perform a complete factory flow test prior to shipment. The test shall be at 25%, 50%, 57% and 100% of design flow and conducted on each pump. A representative of the Owner or of the consulting engineer shall have the option of witnessing the test.
- G. The system shall be complete factory assembled, wired and tested. All package equipment shall be independently third party labeled as a system for its intended use by Underwriters Laboratories, ETL testing services, or a nationally recognized testing laboratory.

1.04 SUBMITTALS

- A. Submit shop drawing and product as specified.
- B. Submit manufacturer's certified capacity data.
- C. Submit manufacturer's installation, start-up and service instructions.
 - 1. Electrical Interlocks
- D. Submit wiring diagram.

1.05 SHIPPING, HANDLING AND STORAGE

- A. Deliver, store, protect, and handle in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. All equipment and accessories shall be suitably boxed, crated, covered and protected internally and externally to prevent shipping damage and damage from the weather.
- B. Inspect and report concealed damage to carrier within specified time.
- C. Store in a clean, dry space. Maintain factory protection or cover to keep out dirt, water, construction debris, and traffic (heat enclosures to prevent condensation).

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Patterson Flo-Pak
- B. Nameco
- C. Grundfos
- D. Taco
- E. Tiger Flow Systems

2.02 PUMPS (TRIPLEX)

- A. The constant pressure booster system shall maintain a constant system pressure of 101 psi (downstream of pressure reducing valves) utilizing an available suction pressure of 0 psig minimum. The unit shall be rated for a total system capacity of 320 GPM at a pressure boost of 191' TDH.
- B. Provide a triplex system with the pumps selected for a 25%-60%-60% split. The pumps shall be similar to a close-coupled end suction pump with cast iron, bronze fitted construction. Each pump shall have a 3 phase, 460V, 60 HZ, 3500 rpm motor with ODP enclosure, and shall operate without overloading the motor at any point on the pump curve.
- C. Pump discharge head calculations shall include a minimum of 18 feet of head to allow for the pressure drop across pump package. Provide certified curve for each pump, certifying the actual tested performance, GPM @ feet TDH, of each pump.

- D. The system shall be equipped with a water temperature sensor manifold to monitor the pump discharge water temperature and activate a self-operated thermal purge valve in the event pump water temperature rises to 110°F. The thermal purge valve shall be factory mounted in the discharge header and shall be field piped to a floor drain.
- E. The system shall be assembled on a structural steel base to adequately support the entire system. Provide a minimum 119 gallon full acceptance bladder tank, rated at 125 psig working pressure, ASME stamped and complete with charging valve. The bladder tank shall be sized to provide a minimum draw down of 24 gallons. The bladder tank shall be shipped loose for field installation adjacent to the booster package. The connection to the tank shall be a 1-1/2 inch minimum line to the jockey (lead) pump discharge, upstream of the pump pressure reducing valve, and after the spring loaded check valve, and shall be provided with full port ball valve for isolation. Water flowing from the bladder tank to the system shall flow through a 1-1/2 inch minimum line through the jockey pump discharge pressure reducing valves. The use of a separate bladder tank system pressure reducing valve is not acceptable.
- F. A set of 4-inch horizontal suction and discharge headers shall be furnished. Headers shall be welded 304 stainless steel pipe with grooved or flanged connections at the suction and discharge headers. Headers shall be machine welded or by ASME Section 9 Certified Welders with smooth water ways with no pipe protruding into header.
- G. Each pump discharge line shall be provided with a Cla-Val 90-01 ADS combination pressure regulating / non-slam check valve of cast iron construction, with bronze pilot valve and stainless steel trim. All block valves 2 inch and smaller shall be full-ported ball valves, bronze body with stainless steel ball and stem. Valves 2-1/2 inch and larger shall be butterfly valves. Provide butterfly valves in the suction and discharge piping connection to each pump. The pump suction line and suction valve shall be sized for a maximum velocity of 7.5 FPS.
- H. Suction and discharge header pressure gauges with ball valves shall be included. A discharge pressure gauge with ball valve shall be provided for each pump to indicate pump pressure upstream of each pump pressure reducing valve. Provide liquid filled pressure gauges, mounted on a common gauge panel with engraved laminated plastic identification plate for each gauge for the following points:
 - 1. Suction and discharge header pressure
 - 2. Pump 1 discharge pressure upstream of pressure reducing valve
 - 3. Pump 2 discharge pressure upstream of pressure reducing valve
 - 4. Pump 3 discharge pressure upstream of pressure reducing valve
 - 5. Bladder tank pressure
- I. Provide in the discharge header a vane type flow switch for low-flow / no-flow indication. The flow switch shall be UL listed equal to a Potter Type VSR-F with a cast aluminum housing.
- J. Provide pressure switches, frame mounted and labeled, for the following pressure indications:
 - 1. Low Suction Level Pressure
 - 2. Low System Pressure
 - 3. Bladder Tank Pressure

2.03 PUMPS (DUPLEX)

- A. The constant pressure booster system shall maintain a constant system pressure of 101 psi (downstream of pressure reducing valves) utilizing an available suction pressure of 0 psig minimum. The unit shall be rated for a total system capacity of 320 GPM at a pressure boost of 191' TDH.
- B. Provide a duplex system with the pumps selected for a 50%-50% split. The pumps shall be similar to a close-coupled end suction pump with cast iron, bronze fitted construction. Each pump shall have a 3 phase, 460V, 60 HZ, 3500 rpm motor with ODP enclosure, and shall operate without overloading the motor at any point on the pump curve.
- C. Pump discharge head calculations shall include a minimum of 18 feet of head to allow for the pressure drop across pump package. Provide certified curve for each pump, certifying the actual tested performance, GPM @ feet TDH, of each pump.
- D. The system shall be equipped with a water temperature sensor manifold to monitor the pump discharge water temperature and activate a self-operated thermal purge valve in the event pump water temperature rises to 110°F. The thermal purge valve shall be factory mounted in the discharge header and shall be field piped to a floor drain.
- E. The system shall be assembled on a structural steel base to adequately support the entire system. Provide a minimum 119 gallon full acceptance bladder tank, rated at 125 psig working pressure, ASME stamped and complete with charging valve. The bladder tank shall be sized to provide a minimum draw down of 24 gallons. The bladder tank shall be shipped loose for field installation adjacent to the booster package. The connection to the tank shall be a 1-1/2 inch minimum line to the jockey (lead) pump discharge, upstream of the pump pressure reducing valve, and after the spring loaded check valve, and shall be provided with full port ball valve for isolation. Water flowing from the bladder tank to the system shall flow through a 1-1/2 inch minimum line through the jockey pump discharge pressure reducing valves. The use of a separate bladder tank system pressure reducing valve is not acceptable.
- F. A set of 4-inch horizontal suction and discharge headers shall be furnished. Headers shall be welded 304 stainless steel pipe with grooved or flanged connections at the suction and discharge headers. Headers shall be machine welded or by ASME Section 9 Certified Welders with smooth water ways with no pipe protruding into header.
- G. Each pump discharge line shall be provided with a Cla-Val 90-01 ADS combination pressure regulating / non-slam check valve of cast iron construction, with bronze pilot valve and stainless steel trim. All block valves 2 inch and smaller shall be full-ported ball valves, bronze body with stainless steel ball and stem. Valves 2-1/2 inch and larger shall be butterfly valves. Provide butterfly valves in the suction and discharge piping connection to each pump. The pump suction line and suction valve shall be sized for a maximum velocity of 7.5 FPS.
- H. Suction and discharge header pressure gauges with ball valves shall be included. A discharge pressure gauge with ball valve shall be provided for each pump to indicate pump pressure upstream of each pump pressure reducing valve. Provide liquid filled

pressure gauges, mounted on a common gauge panel with engraved laminated plastic identification plate for each gauge for the following points:

1. Suction and discharge header pressure
 2. Pump 1 discharge pressure upstream of pressure reducing valve
 3. Pump 2 discharge pressure upstream of pressure reducing valve
 4. Bladder tank pressure
- I. Provide in the discharge header a vane type flow switch for low-flow / no-flow indication. The flow switch shall be UL listed equal to a Potter Type VSR-F with a cast aluminum housing.
- J. Provide pressure switches, frame mounted and labeled, for the following pressure indications:
1. Low Suction Level Pressure
 2. Low System Pressure
 3. Bladder Tank Pressure

2.04 CONTROL PANEL

- A. The control panel shall be a skid mounted, UL listed, NEMA 1 enclosure and prewired to all motors and controls. The panel shall include the following components:
1. One main non-fused disconnect switch, two FVNR magnetic starters with overloads and single phase protection and power failure monitoring.
 2. Full amperage rated, slow blow fused disconnect with internal, manual override switch.
 3. PLC Master control unit with no volatile memory which requires battery back-up shall be allowed.
 4. Provide a H-O-A switch and pump run light in the door of the panel for each pump. These switches shall be in addition to any keypad H-O-A switches and display pump run indication.
 5. The PLC shall alternate the pumps. Pump alternation sequencing shall be field selectable, either on a 24 hour basis, pump demand basis or no alternation.
 6. The control panel shall have a power on light, as well as audible and visual indication of low suction and low discharge pressure. Provide a silencing pushbutton for the audible alarm.
 7. The pump controller shall have 24 hour local service and shall be provided by factory authorized representative.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The entire unit shall be factory assembled, factory electrically tested, including setting of pressure regulating valves. The complete package shall include isolation valves on the suction and discharge of each pump. The only field connection(s) required shall be incoming 480V electrical power, suction and discharge header connections (two connection points only), bladder tank connection, thermal relief valve connection to floor drain, building energy management system monitoring signals and bladder tank drain connection.

3.02 SEQUENCING

- A. The system control panel shall monitor all system conditions; pressures and flow, and sequence the pumps accordingly. The lead pump shall be the primary pump. When the system flow demand approaches the sequencing point of the lead pump, the #1 lag pump flow switch shall actuate and the system controller shall start the #1 lag pump. Both pumps shall run to satisfy the system demand. When the system flow demand exceeds the capacity of the lag pump and the #1 lag pump, #2 lag pump flow switch shall actuate and the system controller shall start the #2 lag pump. All three pumps shall run to satisfy the system demand. As the system demand decreases, the pump shall be shut down in the reverse sequence they were started. The lag pumps shall be automatically alternated on a 24 hour basis. The flow sequencing program shall be set up so as to anticipate peak flow demands and minimize any system pressure drops. Sequencing the lag pumps on pressure alone is not acceptable.
- B. The jockey (lead pump shall operate continuously unless the following three conditions exist: 1) A low flow condition (4 gpm or less) exist as sensed by the low-flow flow switch mounted in the discharge header of the system; the bladder tank is fully charged as indicated by the bladder tank pressure switch; the minimum run time has expired. In the event all conditions have been satisfied, the pump will be shut down and will remain off until the pressure in the bladder tank has fallen to 5 psi below the system pressure. If at any time while the pump is shut down the system demand exceeds 8 gpm as sensed by the low-flow flow switch, the pump will be restarted. Starting and stopping the pump on pressure alone is not acceptable.
- C. In the event of a low suction header pressure alarm condition, all pumps shall be shut down and be automatically restarted upon restoration of the suction pressure. If repeated low suction occurs over a short time period, the alarm will be latched in and must be manually reset.
- D. In the event of a low system pressure alarm, all pumps will be started and the alarm must be manually reset.

3.03 WARRANTY

- A. Manufacturer shall warrant all items to be free of defects in material and workmanship for a period of one year from date of shipment. A Factory Certified Technician shall perform the start-up and calibration of all equipment. The technician shall conduct a training session at the time of start-up for the designated Owner's Representative.

END OF SECTION 22.11.24

SECTION 22.13.16
SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.
- B. Cellular Core PVC pipe is not permitted.

1.02 RELATED WORK

- A. Division 22 Plumbing:
 - 1. Pipe and Pipe Fittings
 - 2. Plumbing Fixtures and Fixture Carriers
 - 3. Drains, Cleanouts and Hydrants
 - 4. Earthwork
 - 5. Plumbing Piping Insulation

1.03 REFERENCES

- A. CISPI - Cast Iron Soil Pipe Institute
- B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All No-Hub clamps must have 4 bands minimum. Sizes 5" through 10" shall have six bands minimum.
 - 1. No-Hub Clamps – Sanitary Waste:
 - a. Husky SD 4000
 - 2. No-Hub Clamps - Vents
 - a. Husky SD – 2000
 - b. Mission Rubber Co., LLC Heavy Weight Couplings
 - 3. Clamp-All Hi-TorQ 80 or approved equal
- B. Provide Fernco "Pro-flex" shielded couplings Series 3000 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2" through 8" Series 3000.

2.02 DRAIN PIPE AND FITTINGS

- A. Above Slab Pipe:
 - 1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
 - 2. Pipe shall conform to ASTM A74.

3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
 4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
 5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute
- B. Below Slab on Grade Piping:
1. Schedule 40 PVC plastic pipe and DWV fittings.
 2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
 3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.

2.03 VENT PIPE AND FITTINGS

- A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
 2. Pipe shall conform to ASTM A74.
 3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
 4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
- B. Below Slab on Grade Piping:
1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.
- C. Above Slab Pipe.
1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards.
- D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed

outside the building slab.

- E. All PVC underground shall be installed in accordance with ASTM D2321.

3.02 GRADE

- A. Give horizontal pipe grade of 1/4-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.03 DRAIN PIPE AND FITTINGS

- A. Offsets and Fittings.
1. Use reduction fittings to connect two pipes of different diameter.
 2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eighth-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
 3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
- B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
 2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
 3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
 4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
- D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.04 VENT PIPING

- A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.
- B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall

comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.

- C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

3.05 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
 - 1. Test pipe below slab on grade before backfilling and connecting to city sewers.
 - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
 - 3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
 - 4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
 - 5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
 - 6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
 - 7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
 - 8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.
- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
 - 1. Plugging outlets.
 - 2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
 - 3. Test for 6 hours without any drop in the water level.

3.06 RODDING SEWERS

- A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner's Representative shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.

- C. This work shall be done in the presence of the Owner's Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.07 SMOKE TESTING

- A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing on all interior sanitary sewer piping and sanitary vent piping above and below floor prior to cover-up..
 2. Artificially created smoke used must be a persistent white tracer smoke and produced by thermogenic chemical reaction. All smoke candles or smoke pencils to be used must be non-toxic and EPA approved. Provided by Superior Signal Smoke Candles.
 3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
 4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
 5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
 6. Typical findings from indoor smoke testing may include:
 - a. Dry traps in floor drains
 - b. Improperly capped sewer lines or vents
 - c. Broken sewer lines or vents
 - d. Cross connected sewer vents and drains
 - e. The drawing of air emanating from sewer vents into intakes of air exchange systems
 - f. Poorly glued pipe joints
 - g. Loose no-hub couplings
 7. An Owner's Representative shall be present during smoke testing.

END OF SECTION 22.13.16

SECTION 22.13.33
SANITARY SEWER LIFT STATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Installation of sanitary sewer lift station including wet well, pump, piping and valves, control panel, dry well and other elements required for a complete operating system.
- B. Lift station capacity as indicated on the Drawings.

1.02 RELATED ITEMS

- A. Division 22 Plumbing
 - 1. Sanitary sewer piping.
- B. Division 26 Electrical

1.03 SUBMITTALS

- A. Submit shop drawings and product data as specified.
- B. Select pump near the mid-point of its performance curve.
- C. Submit manufacturer's certified curve with selections plotted thereon.
 - 1. Show operation with single pump operating and two pumps operating.
- D. Submit manufacturers "Installation, Start-up and Service" instructions.
- E. Submit certified base plate drawings including bolt holes and structural loading.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Flygt Products.

2.02 SEWAGE PUMPS

- A. Pumps shall be combination commutator, submersible pump, capable of reducing sewage and solids to a particulate slurry.
 - 1. Submersible oil-filled motor and lifetime lubrication of bearing.
 - 2. Cast iron pump case and motor housing with all outside fasteners stainless steel.
 - 3. Stainless steel shafts supported by sleeve bearing adjacent to the impeller and heavy-duty, oil-lubricated ball bearing.
 - 4. Bronze impeller, semi-open, nonclog type, nonoverloading design.
 - 5. Impeller and rotating cutters keyed to the shaft for positive drive.
 - 6. Double mechanical shaft seal with oil-filled chamber.

- B. Provide cast iron connection box and cap sufficiently large to facilitate making connections during assembly or disassembly.
 - 1. Motor leads and heavy duty power cord sealed with epoxy compound to prevent water leakage into the motor.
- C. Fit the seal chamber with an electrode probe to signal the alarm panel in the event of water in the seal chamber.
 - 1. Provide an individual alarm.

2.03 CONTROL PANEL

- A. Surface mounted enclosure, suitable for its location.
- B. Components:
 - 1. Combination starter circuit breaker unit for each pump with HOA and pilot light.
 - 2. Automatic alternator with off/on switch.
 - 3. A circuit breaker for alarm circuits.
 - 4. A terminal block for connecting level controls.

2.04 CONTROL SYSTEM

- A. Level controls:
 - 1. DPST mercury switch.
 - 2. Encased in polyurethane or polyvinylchloride eccentrically weighted float.
 - 3. The controls shall be supported by the control cord with a weight attached to the cord to hold control at proper level in the sump pump.
 - 4. Height of control shall be adjustable at the sump cover.
 - 5. Separate removable plate shall be furnished in the cover so that controls can be removed for service as required.
- B. Mode of control:
 - 1. Three level controls for duplex operation.
 - 2. The lower control turn off the pumps.
 - 3. The second control start the lead pump and alternate pumps on each successive cycle.
 - 4. The third control start lag pump or both pumps if level rises to this height.
 - 5. Emergency high level to energize alarm if level continues to rise.

2.05 ALARM PANEL

- A. Surface mounted enclosure, suitable for its location.
 - 1. Activated by contacts in the lift station control panel.
 - 2. An oil tight pilot light to indicate normal operating condition and acknowledge that power is present in the alarm circuit.
 - 3. A weather tight alarm horn and pulsing 2" diameter red light mounted on the front of the alarm panel to provide an adjustable audible/visual signal.
- B. Provide an alarm relay and silence button to allow silencing of the alarm horn.
 - 1. The indicator light will continue to burn indicating normal operation.
 - a. De-energize light whenever system is in alarm.

2. When the alarm condition has been cleared, the panel shall revert to its normal condition automatically.
 3. The silence relay circuit shall reset itself and be ready to initiate another alarm cycle.
- C. Provide auxiliary contact for monitoring by the District Security System
1. Emergency high level.

PART 3 - EXECUTION

3.01 SYSTEM START-UP

- A. Provide the service of a factory authorized service representative approved by the architect/engineer to start-up the lift station.
- B. Submit records and reports of start-up prior to final inspection.

3.02 TESTING OF LIFT STATION

- A. Test the lift station by operation of the completed lift station through four cycles of operation.
- B. Fill the sump to operational levels.
 1. Visually check level controls.
 2. Pump operation.
 3. Valve operation.
 4. Absence of piping leaks, sump leaks, excessive noise and excessive vibration.
 5. Alarms.
 6. Verify pumping capacity.
- C. Submit records of test for approval prior to final inspection.

3.03 INSTALLATION

- A. Install the system in accordance with the manufacturers "Installation, Start-up and Service" instructions.

END OF SECTION 22.13.33

SECTION 22.14.13
ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install roof drains, drain pipes and accessories.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Pipe and Pipe Fittings - General; for general piping requirements.
 - 2. Drains and Cleanouts.
 - 3. Plumbing Piping Insulation.
 - 4. Earthwork

1.03 REFERENCES

- A. CISPI – Cast Iron Soil Pipe Institute
- B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Cast Iron Soil Pipe and Fittings
 - 1. AB&I
 - 2. Charlotte Pipe and Foundry Co.
 - 3. Tyler Pipe / Soil Division

2.02 STORM PIPE AND FITTINGS

- A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- C. Provide Fernco “Pro-Flex” shielded couplings, Series 3000 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2” through 8” use Series 3000.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards, and in accordance with ASTM D2321.

3.02 GRADE

- A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.03 TESTING

- A. Below Floors.
 - 1. Test pipe below floors before backfilling and connecting to sewers.
 - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
- B. System Test. After all the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system:
 - 1. Plugging outlets.
 - 2. Fill vertical sections with water. Provide wyes as required to facilitate plugging.
 - 3. Test for 6 hours without any drop in the water level.

3.04 RODDING SEWERS

- A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. All storm lines below building 3" and larger shall be internally video-taped at time of substantial completion. An Owner's Representative shall be present during video-taping. Three copies of the video-tape shall be delivered to the Owner for future records.
- C. This work shall be done in the presence of the Owner's Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION 22.14.13

SECTION 22.20.00
PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Earthwork
 - 2. Valves, Strainers and Vents
 - 3. Insulation
 - 4. Other Piping Sections

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.02 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.03 GASKETS

- A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.04 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

PART 3 - EXECUTION

3.01 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper and steel press fittings ½" through 4" shall be applied in accordance with the manufacturer's installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-"Pro-Press".

3.02 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.03 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.

- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		1/4
1-1/4" & 1-1/2"	8	5	1/4
2"	10	5	1/4
3"	10	5	3/8
4"	10	5	3/8

3.04 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.05 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.06 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs

and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.07 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.08 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.09 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.10 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.11 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.
- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.
- G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.

3.12 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.13 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION 22.20.00

SECTION 22.31.00
DOMESTIC WATER SOFTENING SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Water softening equipment to remove hardness, (calcium carbonate), to the extent that the effluent from the water softener shall contain 0 grains per gallon of hardness, as determined by an accepted soap hardness test method.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Plumbing Piping Insulation.
 - 3. Valves, Strainers and Vents.

1.03 SUBMITTALS

- A. Submit shop drawings and product data as specified.
- B. Submit manufacturer's certified capacity data.
- C. Submit manufacturer's installation, start-up and service instructions.
 - 1. Electrical interlocks.
- D. Submit wiring diagram.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Marlo
- B. Bruner
- C. Mueller
- D. Unity

2.02 CAPACITY

- A. The water softening equipment shall have the capacity as scheduled on the drawings.

2.03 TANKS

- A. Design tanks for a working pressure of 100 psi.

- B. Design the side shell height to allow a minimum free-board space of 50% of the mineral bed depth for adequate expansion during backwashing.
- C. Steel tanks shall have an 8 to 10 mil DFT epoxy polyamid lining on the interior and a corrosion resistant exterior of 2 to 3 mils DFT rust resistant prime coat and polyurethane gloss enamel top coat.
- D. Tanks shall have a port on the top of the tank for filling.
- E. Tanks will be supported on approved corrosion protected steel legs.

2.04 COLLECTOR

- A. Provide the softener with an approved lower distribution system:
 - 1. Nonclogging strainers to collect soft water and distribute the backwash water.
 - 2. Covered with a minimum of 3" of 1/8" x 1/16" gravel to ensure even distribution of water.

2.05 BRINE SYSTEM

- A. Provide a combination salt storage and brine measuring tank with cover.
 - 1. Large enough to hold salt for at least 4 regenerations of full salting between refills.
 - 2. Molded of corrosion free, rigid polyethylene.
- B. Equip the brine tank with:
 - 1. An elevated salt plate for the collection of concentrated brine.
 - 2. A suitable chamber for housing an automatic air eliminator safety valve.

2.06 AUTOMATIC CONTROLS

- A. Provide a multi-port main control valve or nest of diaphragm valves.
 - 1. Hydraulically actuated.
 - 2. Four position type.
 - 3. Accomplish the regeneration steps of backwash, brine-slow rinse, rapid rinse and service.
 - 4. Include fixed and self-adjusting flow regulators necessary to properly control the rate of flow during the backwash and brine-rinse.
 - 5. Pressures between 30 and 120 psi.
 - 6. Designed to prevent hard water bypass to service during the regeneration cycle.
 - 7. Control valves shall be connected with factory pre-piped galvanized piping.
- B. Control regeneration by a flow sensor with push-button manual override.
 - 1. Permit regeneration at any time of day or night, any day or every day of the week.
 - 2. Make provision for individual adjustment of the backwash and brine-rinse cycles.
 - 3. Provide outputs to the DCS system from the electronic controller of general alarm conditions and flow sensor data.
- C. Enclose control mechanisms in a gasketed moisture resistant case, rated as a NEMA III or NEMA 12 enclosure and conforming to UL specifications.

2.07 AUTOMATIC BRINE SYSTEM

- A. Provide a control system to:
 - 1. Open to admit brine.
 - 2. Close to prevent the entrance of air.
 - 3. Refill the brine tank with the proper amount of water.
- B. Accomplish regulation of the brine dosage by adjustment of a salt dosage dial in the time clock case.
- C. Design the system to allow proper refilling regardless of the salt level in the brine tank.
- D. Furnish a float-operated safety valve as standard equipment to safeguard against brine tank overflow.

2.08 MINERAL

- A. Charge the system with a mineral of the type designed as non-phenolic polystyrene resin.
 - 1. Minimum exchange capacity of 30,000 grains per cubic foot when regenerated with 0.5 lbs. of salt per 1,000 grains of exchange capacity.
 - 2. A solid, of the proper particle size, (not more than 1.8% through 50 mesh U.S. standard screens, wet screening).
 - 3. Contain no agglomerates, shells, plates or other shapes which might interfere with the normal function of the water softener.

2.09 WATER TESTING EQUIPMENT

- A. Provide a sample cock installed for obtaining samples of the effluent water.
- B. Provide a complete water testing kit for conducting a soap test.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. System pipe shall be Type "L" copper with dielectric unions connecting to factory pre-piped galvanized piping, or CPVC pipe and fittings as required to meet local codes.
- B. Arrange piping for easy dismantling to permit cleaning and service.
- C. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

3.02 INSTRUCTIONS

- A. Provide a complete set of instructions covering the installation, operation and servicing of the water softener.

- B. Insert in the Owner's manual.

3.03 SYSTEM MANUFACTURER START-UP SERVICE

- A. Provide the services of factory trained service technicians to start up the system.
 - 1. Technicians shall be trained and experienced on the work they conduct.
- B. Monitor the operation of the softener and set the time clock for an average period between cycles so that regeneration occurs in the early morning hours during a period of zero usage.
- C. Follow the manufacturer's start up procedures.
 - 1. Verify interlocks.
 - 2. Test and verify operation of controls.
 - 3. Calibrate controls.

END OF SECTION 22.31.00

SECTION 22.31.01
SCALE FORMATION PROTECTION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. System shall provide protection from scale formation on internal and external plumbing surfaces through physical water treatment known as Template Assisted Crystallization (TAC). System shall be free from the use of Salts, Electricity, Backwashing and/or Chemical Additives.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping and Appurtenances
 - 2. Plumbing Piping Insulation
 - 3. Valves, Strainers and Vents

1.03 SUBMITTALS

- A. Submit shop drawings and product data as specified.
- B. Submit manufacturer's certified capacity data.
- C. Submit manufacturer's installation, start-up and service instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Watts OneFlow
- B. Approved Equal

2.02 CAPACITY

- A. The scale protection system shall have the capacity as scheduled on the drawings.

2.03 TANKS

- A. Design tanks for a working pressure of 125 psi.

2.04 MINERAL

- A. System shall be free from the use of any salts and/or chemical additives
- B. System shall conform to DVFW Standard W-512 for scale removal efficiency using physical water treatment devices as established by the German Technical and Scientific

Association for Gas & Water.

- C. Media contained within the system shall be tested and certified for material safety to NSF/ANSI Standard 42 and 61.
- D. Media within the system shall be replaced every three years to insure continued scale protection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The system shall be plumbed with a bypass valve to allow isolation of tank(s) and to allow the bypass of untreated water usages in the event that service or media replacement be necessary.
- B. The installation area should be suitable in size for the tank(s) to be serviced without encumbrance and sit upright on a flat level surface.
- C. Tank(s) shall be secured to the floor surface with lag bolts in each tank leg.
- D. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

3.02 INSTRUCTIONS

- A. Provide a complete set of instructions covering the installation, operation and servicing of the scale formation protection system.
- B. Insert in the Owner's manual.

3.03 SYSTEM MANUFACTURER START-UP SERVICE

- A. Provide the services of factory trained service technicians to start up the system.
 - 1. Technicians shall be trained and experienced on the work they conduct.

END OF SECTION 22.31.01

SECTION 22.33.13
INSTANTANEOUS ELECTRIC WATER HEATER

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Plumbing Piping Insulation.
 - 3. Division 26 Electrical.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Chronomite
- B. EEMAX

2.02 PRODUCTS

- A. Provide tankless, flow switch activated heater.
- B. Hot water temperature range of 103°F to 120°F.
- C. 0.5 GPM flow rate.
- D. Low pressure model if required. Contractor shall verify pressure at site.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install where shown on Drawings and in accordance with manufacturer's requirements.

3.02 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION 22.33.13

SECTION 22.33.34
ELECTRIC WATER HEATER (Commercial - Non-ASME)

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Plumbing Piping Insulation.
 - 3. Division 26 Electrical.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Lochinvar
- B. State
- C. Rheem/Ruud
- D. A. O. Smith

2.02 PRODUCTS

- A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
- B. Provide a tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
- C. Furnish factory-assembled, integral units equipped as follows:
 - 1. Extruded high density anode rod.
 - 2. Individually mounted thermostat at each element with a high temperature cutoff.
 - 3. High temperature limit switch (energy cutout).
 - 4. UL rated.
 - 5. Temperature and pressure relief valve.
- D. Provide medium watt density elements having zinc-plated copper sheathing and prewired leads.
- E. The outer jacket shall be baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panels and shall enclose the tank with foam insulation.

- F. Electrical junction box with heavy duty terminal block shall be provided.
- G. Heater shall have a three year limited warranty.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installations shall be in accordance with the manufacturer's published recommendations.
- C. Furnish all supports required by the equipment included in this Contract.
- D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.
- E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
 - 1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
 - 2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.
- F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.
- G. Route condensate to a vented receiver.
- H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.
- I. Set the operating and safety controls.
- J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.
- K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.
- L. Install water heater in galvanized drain pan piped to floor drain.

3.02 STARTUP

- A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance

training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

3.03 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION 22.33.34

SECTION 22.34.30
GAS-FIRED DOMESTIC WATER HEATER / TANK TYPE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Gas-fired domestic hot water heating systems, including hot water heaters, storage tanks, control valves, and pressure and temperature relief valves, as required.

1.02 RELATED ITEMS

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Gas Piping.
 - 3. Flue Piping.
 - 4. Plumbing Piping Insulation.

1.03 CERTIFICATION

- A. Provide water heater listed by the American Gas Association Laboratories as a circulating-tank water heater and automatic storage water heater for outlet water temperature of 140°F.

PART 2 - PRODUCTS

2.01 CAPACITY

- A. Water heaters shall have the storage capacity and gallons per hour recovery at 100°F rise as scheduled.

2.02 TANK

- A. Construct the tank with a 125 psi ASME rating in accordance with the ASME Code, Section IV. For the tank lining, use a metal that is not self-sacrificing, such as nickel, copper or stainless steel.

2.03 BURNER

- A. Provide multiple tubular constructed aluminized steel burner, mounted in a removable tray permit field replacement.

2.04 INSULATION

- A. Insulate the water heater with factory applied fiberglass and trim with a heavy-gauge, enameled steel jacket.

2.05 CONTROLS

- A. Furnish 120V controls for heaters of 100,000 BTUH and above. Provide controls designed to shut off the gas to main burners and pilot burners in the event of gas or pilot failure.

- B. Include a temperature limiting device with automatic reset, an ASME-rated pressure relief valve, and a manual gas shut-off valve.

2.06 FLUE

- A. Use water heater flues of indicated sizes and as specified in other sections. Extend flues from the diverter through the roof and terminate with a vacuum cap of approved design. Include an approved flashing where the flue pierces the roof.

2.07 ACCEPTABLE MANUFACTURERS

- A. P.V.I.
- B. Sellers.
- C. Lochinvar
- D. State

2.08 STORAGE TANK

- A. System shall include a tank with a nominal storage capacity as scheduled on drawings.
- B. Tank shall be guaranteed to supply 80% of tank capacity without a drop in outlet temperature, regardless of the rate of draw.
- C. Tank shall be built with a working pressure of 150 PSI, be glass or epoxy lined, and have a five year warranty.
- D. The entire system shall be jacketed and insulated to meet the energy efficiency of ASHRAE 90.1-1989, Addendum 90.1b-1992.
- E. Jacket dimensions shall be as scheduled on the drawings. Jacket shall be minimum 18 gauge steel, galvanized inside and out, and protected by an acrylic or glass finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installations shall be in accordance with the manufacturer's published recommendations.
- C. Furnish all supports required by the equipment included in this Contract.
- D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.

- E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
 - 1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
 - 2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.
- F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.
- G. Route condensate to a vented receiver.
- H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.
- I. Set the operating and safety controls.
- J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.
- K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.
- L. Install water heater in galvanized drain pan piped to floor drain.

3.02 STARTUP

- A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION 22.34.30

SECTION 22.40.00
PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.02 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
 - 1. American Standard.
 - 2. Kohler.
 - 3. Toto
 - 4. Zurn
- B. Plumbing Faucets:
 - 1. American Standard.
 - 2. Chicago.
 - 3. T&S Brass.
 - 4. Zurn.
 - 5. Symmons
 - 6. Speakman
 - 7. Moen Commercial
- C. Supports and Carriers:
 - 1. Wade
 - 2. Zurn
 - 3. J.R. Smith.
 - 4. Josam.
 - 5. Watts
- D. Flush Valves:
 - 1. Sloan
 - 2. Zurn
 - 3. Moen Commercial
- E. Supplies, Stops and Chrome Plated Tubular Brass:
 - 1. McGuire
 - 2. Kohler

- 3. Chicago
- 4. Zurn
- F. Water Closet Seats:
 - 1. Beneke
 - 2. Church
 - 3. Olsonite
 - 4. Bemis
 - 5. Centoco
- G. Electric Drinking Fountains:
 - 1. Halsey Taylor
 - 2. Elkay
 - 3. Oasis
 - 4. Haws
- H. Floor Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts
 - 6. Sioux Chief
- I. Cleanouts:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts
- J. Shower Systems:
 - 1. Bradley
 - 2. Acorn
 - 3. Willoughby
- K. Shower Valves
 - 1. Chicago
 - 2. Acorn
 - 3. Symmons
 - 4. Bradley
 - 5. Moen Commercial
- L. Shower Stall
 - 1. Aquabath
 - 2. Aquatic
 - 3. Aquarius
 - 4. Best Bath Systems (Access)
- M. Stainless Steel Sinks:
 - 1. Elkay

- 2. Just
 - 3. Griffin
 - 4. Moen Commercial
 - 5. Amtekco Industries

- N. Mop Sinks:
 - 1. Crane Fiat
 - 2. Stern Williams
 - 3. Acorn
 - 4. CECO

- O. Service Sinks:
 - 1. American Standard
 - 2. Kohler
 - 3. Eljer
 - 4. CECO

- P. Roof Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts

- Q. Thermostatic Mixing Valves
 - 1. Lawler
 - 2. Symmons
 - 3. Leonard
 - 4. Powers
 - 5. Holby
 - 6. Bradley

- R. Emergency Safety Equipment
 - 1. Speakman
 - 2. Bradley
 - 3. Encon
 - 4. Guardian
 - 5. Haws

- S. Shock Arrestors:
 - 1. Precision Products
 - 2. Sioux Chief

- T. Backflow Preventors
 - 1. Watts
 - 2. Febco
 - 3. Wilkins
 - 4. Beeco

- U. Hose Bibbs
 - 1. Wade

2. Chicago
3. Josam
4. Woodford
5. Zurn
6. J.R. Smith

- V. Wall Hydrants
1. Wade
 2. Woodford
 3. Zurn
 4. J.R. Smith
 5. Josam

- W. Solids Interceptors
1. Wade
 2. J.R. Smith
 3. Zurn
 4. Josam
 5. Schier

2.02 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
- H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.
- I. All floor drains and floor sinks shall have Pro-Set "Trap Guard" for trap seal protection.

- J. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.
- K. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal resistant screws.
- L. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION 22.40.00

SECTION 22.63.11
GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.02 RELATED WORK

- A. Division 22 Plumbing
 - 1. Plumbing Pipe and Fittings
 - 2. Valves and Vents

1.03 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
 - 1. Schedule 40 ASTM A 53 black steel pipe
 - 2. Factory fabricated socket weld fittings.
 - 3. Where approved for a specific project and where accepted by local code, cold press mechanical joint fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements shall be HNBR and the fittings shall bear the CSA stamp to confirm acceptability for fuel gas systems. MegaPress system manufactured by VIEGA including "Smart Connect" to assure unpressed fittings will not hold pressure. Installers shall carry training credentials from the manufacturer to confirm they have been instructed in the correct installation procedures.
- B. Pipe Larger than 2 inch:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
 - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
 - 2. Ground joint unions, with bronze seat.
 - 3. Flange joints for pipe larger than 2 inch in diameter.

- D. Flanges:
 - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.02 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.
- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.03 PIPE AND FITTINGS - IN SLEEVE TO ISLAND LAB TABLES (use only where allowed or required by City)

- A. Corrugated stainless steel tubing meeting ASTM A240, type 304, with polyethylene jacketing, flame retardant ASTM E84 index flame 25, smoke 20, with cast bronze fittings. Gastite or approved equivalent.

2.04 PIPE AND FITTINGS - IN UTILITY TRENCH TO ISLAND LAB TABLES

- A. Pipe as specified in paragraph 2.1 above, run in utility trench similar to ABT, Inc., Polyduct Utility Trench, 39.2 inch long sections x 12 inches wide x 7 inches deep rectangular polymer concrete, non-sloping, flat bottom, solid cover steel floor plate bolted to unitized frame.

2.05 VALVES

- A. See Section 22 05 23.

2.06 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed ANSI (American National Standard) E2.180A-2000 and CSA (Canadian Standards Association Standard) CGA6.22A-M00.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.

- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
 - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
 - 2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent PVC sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Weld all gas piping above grade.
- G. Provide test ports and isolation valves to enable proper testing of system in the future.
- H. Provide isolation valve and unions across regulators for proper removal.
- I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- J. Gas Pressure Regulators / Vents:
 - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors.
 - 2. Install vent piping from regulators to location to prevent gas smells from entering building.
 - 3. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering.
 - 4. When installed inside building route vents horizontally and terminate through building sidewall. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
 - 5. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.

3.02 TESTING GAS PIPING

- A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.

- F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
 - 1. To find form online, go to: Texas School Gas Test Form
- G. School renovations projects shall have all gas piping tested. Report and document gas leaks found to the Architect and Engineer. Repair leaks at no additional cost to the Owner.

3.03 IDENTIFICATION CONDUCTOR

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
- B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
 - 1. Bolted gasketed cover with stainless steel screws.
 - 2. Screw type terminal strip.
 - 3. Legend on cover "gas pipe identification conductor."
- C. Set in concrete pad.

3.04 UNDERGROUND STEEL PIPE

- A. Reference Specification Section 22 20 02, Underground Steel Pipe Corrosion Protection.

3.05 PAINT EXPOSED OUTSIDE GAS PIPE

- A. Interior and Exterior Gas piping shall be protected from rust.
- B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION 22.63.11

SECTION 23.01.00
HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.02 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Schedule of filters for each item of equipment.
 - 11. Schedule of belts for each item of equipment.
 - 12. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.01 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.01 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

- 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
- h. As installed control diagrams by controls manufacturer.
- i. Complete equipment internal wiring diagrams.
- j. Schedule of filters for each air handling system.
- k. Schedule of belts for each item of equipment.
- l. Each Contractor's coordination drawings.
- m. As installed color coded piping diagrams.
- n. Charts of valve tag number, with location and function of each valve.
- o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
- p. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 23.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide extended compressor warranty certificates.

END OF SECTION 23.01.00

SECTION 23.05.00
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.
- B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.02 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Mechanical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Americans with Disabilities Act Standards
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.03 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.04 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum

for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.05 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations and sizes of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of the project, obtain without cost to the Owner, copies of the original drawings and transfer as-built changes to these. Provide a hard copy of this As-Built Set for the owner's records. The As-Built Set must include all drawings, regardless of whether corrections were necessary. Digital copies of the As-Built Set shall be provided to the architect and engineer. Digital drawings shall be in PDF format. The delivery of the As-Built Set is a condition of final acceptance.
- C. Drawings in the As-Built Set should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's seal, name, address and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 - 6. Indicate exact location of all underground mechanical piping and elevation.
 - 7. Indicate exact location of all underground electrical raceways and elevations.
 - 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
 - 10. Exact location of all electrical equipment in and outside of the building.
 - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 12. Cloud all changes.

1.07 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.08 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.09 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.02 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.03 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.04 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing building slab
- D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.05 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 4 hours dedicated instructor time.
 - 2. 4 hours on each of 1 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents

of manual with personnel in detail to explain all aspects of operation and maintenance.

- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.06 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.07 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.08 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.09 INDOOR AIR QUALITY

- A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.
- B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.
- C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.
- D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.
- E. Utilize manufacturer's recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.
- F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.
- G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.
- H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION 23.05.00

SECTION 23.05.10
HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.02 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.03 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.04 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step, in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.05 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.06 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.

4. Start-up of equipment.
 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.01 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.01 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials that may trap condensate and cause corrosion.

END OF SECTION 23.05.10

SECTION 23.05.11
MECHANICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.02 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or the modification of existing operational systems.

1.03 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation and, when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Verify actual HVAC supply and return piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.02 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.03 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.

- B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.
- C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.
- G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.
- H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities which do not provide service to the buildings that remain unless otherwise instructed in the construction documents.
- K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

3.04 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.
- H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.05 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.06 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be

reused and located within the renovated areas. Do not include the description “existing”. Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

3.07 REFRIGERANT DISPOSAL

- A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes. Contractor shall document refrigerant disposal as part of contract.

END OF SECTION 23.05.11

SECTION 23.05.12
SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.02 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.03 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}" = 1'-0"$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment

- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.04 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.05 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.06 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.

- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.07 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name, address and contact number.
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor

- b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
- 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.08 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.09 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 23.05.12

SECTION 23.05.13
ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for mechanical equipment.
 - 2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
 - 5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
 - 6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
 - 7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
 - 8. Pipe heat tracing.
 - 9. Radiant heater timer switches and/or thermostats.
 - 10. Low Voltage thermostat wiring.
- C. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.
- D. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.
- E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.02 RELATED WORK

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

1.03 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.04 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.01 MOTORS

- A. Provide motors for mechanical equipment manufactured by one of the following:
 - 1. Baldor Electric Company.
 - 2. Century Electric Div., Inc.
 - 3. General Electric Co.
 - 4. Louis Allis Div.; Litton Industrial Products, Inc.
 - 5. Lincoln Electric
 - 6. Marathon Electric Mfg. Corp.
 - 7. Reliance Electric Co.
 - 8. Westinghouse Electric Corp.
 - 9. WEG
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:
- C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
 - 1. Frames. NEMA #56.

2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

2.02 EQUIPMENT FABRICATION

- A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

2.03 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

- A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.
- B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION 23.05.13

SECTION 23.05.14
HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.02 RELATED WORK

- A. Division 23 - Mechanical
 - 1. Insulation
 - 2. Fan/Coil Units
 - 3. Air Handling Units
 - 4. Equipment Drain Pans

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings in plenum areas. Type PVC with drainage pattern fittings in non-plenum areas.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the system to facilitate easy removal.
 - 1. Use threaded plugged tee at each change of direction to permit cleaning.
 - 2. Install a cleanout every 50 feet of straight run piping
 - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
 - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
 - 1. Confirm requirements with manufacturer's installation instructions

3.02 SIZE PIPE AS SHOWN ON DRAWINGS.

- A. Do not install piping sized smaller than the unit drain connection size.

3.03 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION 23.05.14

SECTION 23.05.15
HVAC SYSTEM EARTHWORK

PART 1 - GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of mechanical work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.
- B. Cut the bottom of the trench or excavation to uniform grade.
- C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.
- D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect / Engineer before proceeding.

3.02 BACKFILL

- A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified.
- B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
- C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.
- D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.03 DISPOSAL OF EXCESS MATERIAL

- A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner / Architect.

END OF SECTION 23.05.15

SECTION 23.05.16
EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE
BUILDING SLAB

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
- B. Refer to Instructions to Bidders for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of the specifications.

1.02 WORK INCLUDED

- A. Coordinating all excavating and backfilling for the underground refrigerant piping, and all related appurtenances.
- B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Earthwork
- B. Refrigerant Piping and Appurtenances

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM) Use current edition.
 - 1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 - 2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. Local Governing Agencies

1.05 WARRANTY

- A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.
- B. Sand: Clean, local sand
- C. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.01 EXCAVATION

- A. General:
 - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
 - 2. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
 - 3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.
- B. Appurtenances:
 - 1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.
- C. Refrigerant Line Trenches:
 - 1. Refrigerant lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
 - 2. Trench width for refrigerant lines shall be a minimum of the outside pipe diameter plus 18 inches.
 - 3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.02 PIPE BEDDING AND BACKFILL

- A. Refrigerant Line Trenches:
 - 1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
 - 2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
 - 3. For refrigerant lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95% Standard Proctor.
 - 4. For refrigerant lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8" loose depth. Each lift shall be compacted to a minimum of 90% of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.

- B. Utility Locators:
 - 1. Provide metallic locator over all underground utilities, including irrigation piping, plumbing, control wiring, conduit, data, etc. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION 23.05.16

SECTION 23.05.17
MECHANICAL ACCESS DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.01 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Automatic closing and latching mechanism
- F. Prime coat finish
- G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- H. Material suitable for wall and/or ceiling mounting

2.02 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish

- J. Material suitable for wall and/or ceiling mounting

2.03 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 36" x 24" for Mechanical HVAC equipment related items
 - 2. 18" x 18" for electrical related items

END OF SECTION 23.05.17

SECTION 23.05.48
VIBRATION ISOLATION

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish, install, and adjust vibration isolation.

1.02 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
 - 2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.03 SUBMITTALS

- A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Amber Booth
- B. Kinetics
- C. Mason
- D. Korfund
- E. VSI.
- F. Vibration Eliminator Co., Inc.
- G. Metraflex

2.02 ISOLATOR TYPES

- A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
- B. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4 inch (6mm) neoprene acoustical friction pad between the base plate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring

diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

- C. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

2.03 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Air Handling Units		
Floor Mounted – up to 15 HP	B	1"
Floor Mounted – 20 HP and Over	B	1.5"
Suspended	D	1"
Suspended Fan Coil Units	D	0.5"
Floor Mounted Fan Coil Units	A	0.35"
Condensing Units	A	0.35"
In-Line Fans	D	0.5"

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.
- B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION 23.05.48

SECTION 23.05.93
TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Balance, adjust and test the hydronic system.
- C. Verify and record the duct test results performed by the mechanical contractor.

1.02 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.03 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall bid the project directly to the General Contractor.

1.04 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.05 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.

- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
- E. The balancing agency shall have operated for a minimum of five years under its current name.
- F. Personnel:
 - 1. The project supervisor shall be a Professional Engineer and have:
 - a. Extensive knowledge of the work involved.
 - b. At least five years of experience conducting tests of the type specified.
 - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
 - 2. All work shall be conducted under the direct supervision of the supervising engineer.
 - 3. Technicians shall be trained and experienced in the work they conduct.

1.06 WARRANTY

- A. Provide (AABC) guarantee in writing.
- B. Extended warranty.
 - 1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
 - 2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
 - 3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 TAB TOLERANCES

- A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.02 SITE VISITS

- A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other

component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.

- B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.
- C. Note proper piping installation, location of valves, and flow measuring instruments.
- D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.
- E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.03 TESTING INSTRUMENTS

- A. Submit a list of all instruments to be used for the test and balance procedures.
 - 1. Catalog sheets
 - 2. Certificate of last calibration
 - 3. Calibration within a period of six months prior to balancing
- B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.04 COORDINATION WITH OTHER SPECIFICATION SECTIONS

- A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.
- B. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
 - 1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
 - 2. Verify that all control devices are properly connected.
 - 3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
 - 4. Verify that all dampers and valves are in the position indicated by the controller

- (open, closed or modulating).
 5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
 6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
 7. Observe the calibration of all controllers.
 8. Verify the proper application of all normally opened and normally closed valves.
 9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
 10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
 11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
 12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
 13. Check all dampers for free operation.
 14. Verify that all controller setpoints meet the design intent.
 15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.
- C. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineer's office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.05 INSTRUMENT TEST HOLES

- A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
1. Drill holes, plug, and tape external duct insulation.
 2. Repair damaged insulation to Engineer's approval.

3.06 TESTING THE AIR DISTRIBUTION SYSTEM

- A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
1. Supply Fans:
 - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
 - b. Current and Voltage: Test and record motor voltage and amperage. Then, compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube

- traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
- d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
 - e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
2. All Other Fans:
- a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
 - b. Current and Voltage: Test and record motor voltage and amperage. Then, compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
 - d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.
3. VAV Terminal Units:
- a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
 - b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
4. Diffusers, Registers and Grilles:
- a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
5. Coils (including electric coils):
- a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.
- B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.
- C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.

- E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.
- F. Measure and adjust all supply and return branches to design air delivery.
- G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- H. Make a set of recordings showing final system conditions.

3.07 TESTING THE HYDRONIC SYSTEMS

- A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
 - 1. Record preliminary pump data.
 - a. Pump RPM.
 - b. Pump shut-off differential head.
 - c. Pump operating differential head.
 - d. Check and verify pump alignment.
 - e. Verify impeller diameter.
- B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.
- C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.
- D. Balance flow through:
 - 1. Chillers.
 - 2. Coils.
 - 3. Boiler.
 - 4. Pumps
- E. Use flow meters, differential pressures and temperature relationships as required.
- F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.
- G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.
- H. Pumps:
 - 1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.

Check and verify pump alignment.

2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

I. Coils:

1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.

J. Boilers:

1. Verify that boilers have been filled and started by others, and are in operation.
2. Current and Voltage: As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
3. Test, adjust and record water flows through water boilers.
4. Test and record water temperature profiles of each boiler.

K. Chillers:

1. Verify that chillers have been started by the manufacture and are in operation. Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.

3.08 EQUIPMENT POWER READINGS

A. Record the following information for each motor:

1. Equipment designation.
2. Manufacturer.
3. Unit model number and serial number and frame.
4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
5. Heater coil in starter.
 - a. Rating in amperes.
 - b. Manufacturer's recommendation.
6. Motor RPM/driven equipment RPM.
7. Power reading (voltage, amperes of all legs at motor terminals).

3.09 BOILERS

A. Check for proper operation and with operation at near design conditions, record the following:

1. Manufacturer, model number, serial number and nameplate.
2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
3. Type of fuel and heating value.

4. Rate of fuel consumption.
 5. Capacity in MBH.
 6. Efficiency.
 7. Flue gas analysis.
 8. Motor data.
- B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

3.10 CHILLERS (Air Cooled)

- A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.
- B. Verification of safety interlocks and controls are the responsibility of the manufacturer.
- C. With each chiller operating at near design temperature conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
 3. Condenser air entering temperature, leaving temperature.
 4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
 5. Volts and amps for each phase.
 6. Power factor.
 7. KW input.
 8. Tons of cooling.
 9. KW per ton of cooling.
- D. Reference chiller specification for additional requirements.

3.11 DUCT TEST

- A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.12 DIRECT EXPANSION EQUIPMENT

- A. With each unit operating at near design conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
 2. Ambient temperature, condenser discharge temperature.
 3. Amperage and voltage for each phase.
 4. Leaving and entering air temperatures.
 5. Suction and discharge pressures and temperatures.
 6. Tons of cooling.
 7. Verification that moisture indicator shows dry refrigerant.

3.13 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
 - 1. Title Page
 - a. Company Name
 - b. Company Address
 - c. Company telephone number
 - d. Project name
 - e. Project location
 - f. Project Manager
 - g. Project Engineer
 - h. Project Contractor
 - i. Project Identification Number
 - 2. Summary of the TAB report data
 - 3. Index
 - 4. Instrument List
 - a. Instrument
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Range
 - f. Calibration Date
 - g. What test instrument is to be used for:
 - 5. Fan Data
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Air flow, specified and actual
 - e. Total static pressure (total external) specified and actual
 - f. Inlet pressure
 - g. Discharge pressure
 - h. Fan RPM
 - 6. Return Air/Outside Air Data
 - a. Identification/location
 - b. Design return air flow

- c. Actual return air flow
 - d. Design outside air flow
 - e. Actual outside air flow
 - f. Return air temperature
 - g. Outside air temperature
 - h. Required mixed air temperature
 - i. Actual mixed air temperature
- 7. Electric Motors
 - a. Manufacturer
 - b. HP/BHP
 - c. Phase, voltage, amperage, nameplate, actual
 - d. PM
 - e. Service Factor
 - f. Starter size, heater elements, rating
- 8. V-Belt Drive
 - a. Identification/location
 - b. Required driven RPM
 - c. Drive sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave, diameter and RPM
 - f. Center-to-center distance, maximum, minimum and actual
- 9. Duct Traverse
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air correction factor
- 11. Air Distribution Test Sheet
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Correction factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
- 12. Pump Data
 - a. Identification/number
 - b. Manufacturer
 - c. Size/model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop, BHP
 - g. Actual flow rate, pressure drop, BHP
 - h. Discharge pressure

- i. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures
 - l. Shut off, total head pressure
 - m. Pressure differential settings
- 13. Cooling Coil Data
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Entering air WB temperature, design and actual
 - g. Leaving air DB temperature, design and actual
 - h. Leaving air WB temperature, design and actual
 - i. Water pressure flow, design and actual
 - j. Water pressure drop, design and actual
 - k. Entering water temperature, design and actual
 - l. Leaving water temperature, design and actual
 - m. Air pressure drop, design and actual
 - n. Capacity - sensible and latent
- 14. Heating Coil Data
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Leaving air DB temperature, design and actual
 - g. Water pressure flow, design and actual
 - h. Water pressure drop, design and actual
 - i. Entering water temperature, design and actual
 - j. Leaving water temperature, design and actual
 - k. Air pressure drop, design and actual
 - l. Capacity
- 15. Electric Coil Data
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Leaving air DB temperature, design and actual
 - g. Electrical Characteristics
 - h. Capacity
- 16. Sound Level Report
 - a. Location (Location established by the design engineer)
 - b. N C curve for eight (8) bands-equipment off
 - c. N C curve for eight (8) bands-equipment on
- 17. Vibration Test on equipment having 10 HP motors or greater in size.
 - a. Location of points:
 - 1) Fan bearing, drive end
 - 2) Fan bearing, opposite end

- 3) Motor bearing, center (if applicable)
- 4) Motor bearing, drive end
- 5) Motor bearing, opposite end
- 6) Casing (bottom or top)
- 7) Casing (side)
- 8) Duct after flexible connection (discharge)
- 9) Duct after flexible connection (suction)
- b. Test readings:
 - 1) Horizontal, velocity and displacement
 - 2) Vertical, velocity and displacement
 - 3) Axial, velocity and displacement
- c. Normally acceptable readings, velocity and acceleration
- d. Unusual conditions at time of test
- e. Vibration source (if non-complying)
- 18. Control verification indicating date performed and any abnormalities identified.
 - a. Point Location/Description
 - b. EMS Readout (Setpoint and Actual)
 - c. Actual Readout of all points
 - d. Interlocks
 - e. Safeties
 - f. Variable speed drive tracking with EMS input
 - g. Variable speed drive Bypass operation
 - h. Sequence of operation

END OF SECTION 23.05.93

SECTION 23.05.94
COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.01 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.01 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
 - 1. Install air terminal devices.
 - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
 - 3. Verify lubrication of equipment.
 - 4. Install permanent instrumentation.
 - 5. Clean piping systems and fill with clean water.
 - 6. Complete "Start-up" of equipment.
 - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
 - 8. Verify ratings of overload heaters in motor starters.
 - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
 - 10. Provide control diagrams and sequence of operation.
 - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
 - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
 - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
 - 14. Comb out fins on extended-surface heat transfer coils where damaged.
 - 15. Clean all strainers as required.
 - 16. Remove construction strainers after water is cleaned and treated.
 - 17. Remove all temporary filters from HVAC equipment.
 - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
 - 1. The specified pieces of equipment have been checked, started, and adjusted by

- the manufacturer.
 - 2. Other equipment has been checked and started.
 - 3. The systems have been operated for the specified period of time.
 - 4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
- E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.
- F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.
- G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.02 START-UP OF EQUIPMENT

- A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
- B. Complete start-up of equipment prior to start of testing & balancing.
- C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

[illegible]

END OF SECTION 23.05.94

SECTION 23.07.13
EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.02 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
 - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
 - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
 - 3. Insulation. Refer to specific sections on individual insulation types.
 - 4. Refer to insulation and liner plan detail.

1.03 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.

- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.04 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.
- B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.01 INSULATION

- A. Glass fiber rigid duct insulation.
 - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Schuller 814 spin-glas FSK.
 - b. Owens-Corning Type 703 board RKF.
 - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
 - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Manville R-series Microlite FSKL.
 - b. Owens-Corning ED100 RKF.
 - c. Knauf 1.0 PCF FSK.

- C. Fiberglass reinforcing cloth mesh.
 - 1. Acceptable Manufacturers
 - a. Perma Glass Mesh.
 - b. Alpha Glass Mesh.
 - c. Childers Chil-Glas #10
 - d. Foster Mast a Fab
 - e. Vimasco.
 - D. Mastics, sealants, coatings and adhesives.
 - 1. Acceptable Manufacturers
 - a. Childers.
 - b. Foster.
 - c. Vimasco.
 - E. Rigid Closed Cell Insulation
 - 1. Acceptable Manufacturers
 - a. Dow Trymer.
 - b. Phenolic Foam.
 - F. Reinforced Foil Tape
 - 1. Acceptable Manufacturers
 - a. Venture 1525CW
 - b. 3" FSK
 - 2. Thickness 6.5 mils
 - 3. Color: silver
- 2.02 COATING AND ADHESIVE
- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
 - B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
 - C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
 - D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.
- 2.03 OUTDOOR DUCT LAMINATED JACKETING
- A. Rubberized bitumen compound material:
 - 1. Ultraviolet resistant
 - 2. Weatherproof
 - 3. Vapor retarding jacketing
 - 4. Laminated jacketing
 - 5. Cross-laminated high strength polyethylene film

6. Laminated to aluminum foil
 7. Minimum 60-mil thickness
- B. Acceptable Manufacturers:
1. Alumaguard 60
 2. Flex Clad 400
 3. Venture Clad 1577CW

PART 3 - EXECUTION

3.01 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.02 CONCEALED DUCT

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
- B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
- D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers, and taped with a minimum 3" wide strip of glass fabric embedded in coating. Cover all seams, joints, pin penetrations and other breaks with vapor barrier coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.
- D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.
- E. Ductwork in mechanical rooms is considered concealed spaces.

3.03 EXPOSED DUCT INSULATION

- A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
1. Apply fabric and mastic to provide a smooth surface for painting.

- B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.
- D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.04 OUTDOOR DUCTWORK COVERING

- A. Cover all supply and return ductwork outdoors:
 - 1. 1-1/2" thick, rigid closed cell insulation with reinforced foil facing.
- B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.
- C. Impale the insulation over mechanical fasteners and washers.
 - 1. A minimum of 2 rows of fasteners per side on 12-inch centers.
 - 2. Seal all breaks, joints and punctures by applying a 1/8" thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.
- D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4".
- E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
 - 1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4".
 - 2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8".
 - 3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
 - 4. Aluminum gray or white finish as approved by the Architect.
- F. Standing water on horizontal surfaces is not approved.
- G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.05 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Apply insulation on clean, dry surfaces only.
- C. Continue insulation with vapor barrier through penetrations.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.
- F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.
- G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION 23.07.13

SECTION 23.07.19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including refrigerant lines, and condensate piping.

1.02 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.03 SUBMITTALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each

product.

- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.04 RELATED WORK

- A. Finishes. Painting and color-coding
- B. Pipe Heat Tracing

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
 - 1. Johns-Manville Micro-Lok AP-T
 - 2. Owens-Corning ASJ/SSL
 - 3. Knauf ASJ/SSL
- B. Cellular Glass Insulation (Foamglass):
 - 1. Pittsburg Corning
 - 2. Cell-U-Foam
- C. Rigid Foam Insulation:
 - 1. Kingsapan Tarec
 - 2. Dow Trymer
 - 3. Tarec Ecophen – Phenolic Foam
- D. Aluminum Jacketing:
 - 1. ITW Lock-on (Childers)
 - 2. ITW Z-lock (Pabco)
- E. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Foster Mast a Fab
 - 5. Vimasco
- F. Mastics, Sealants, Coatings and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armacell 520 Adhesive
- G. Elastomeric Insulation
 - 1. Armacell

- H. Weather Resistant Coating
 - 1. WB Armaflex Finish
 - 2. Foster 30-64
- I. Glass fiber blanket insulation
 - 1. Manville R-series Microlite FSKL
 - 2. Owens-Corning eD75 or ED100 RKF
 - 3. Knauf 0.75 PCF FSK
- J. Fire Barrier Plenum Wrap Insulation
 - 1. Totally encapsulated with foil facing
 - 2. Single layer fire protection
 - 3. Plenum Protection System UL910
 - 4. Acceptable Manufacturers
 - a. FyreWrap 0.5 Plenum Insulation
 - b. 3M Fire Barrier Plenum Wrap 5A

2.02 RIGID FOAM PIPE INSULATION

- A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
 - 1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
 - 2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
 - 3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

2.03 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
 - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.04 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than 3/4" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.
 - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.05 CELLULAR GLASS INSULATION

- A. ASTM C552:
 - 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);

2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.06 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
 1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.07 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.
- B. Vapor Barrier Finish:
 1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
 2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
 3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.
- C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.
- D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.
- E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.
- F. Other products of equal quality will be acceptable only upon approval.

2.08 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.09 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

2.10 FIRE BARRIER PLENUM WRAP

- A. High temperature insulation blanket specifically designed to provide a single layer, flexible enclosure around combustible items located within fire rated return air plenums.
- B. Use of this method is subject to approval of the Local Authority Having Jurisdiction.

PART 3 - EXECUTION

3.01 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-38 or Foster 30-80 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging adhesive Foster 30-35 or Childers CP-35 over all exposed insulation within mechanical rooms.
- G. Piping to be insulated as specified above:

1. Domestic hot and cold water
2. Horizontal sanitary drain piping that receives condensate
3. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body to elbow, all horizontal rain leaders, and first elbow turning down

3.02 REFRIGERANT AND CONDENSATE PIPING

- A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.
- B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.
- C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.
- D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

3.03 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
 1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
 2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
 3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2" on adjoining sections of pipe insulation.
 4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
 5. Apply coating/mastic to a wet film thickness of 3/64".
 6. Fabric shall not be visible after completion.
 7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

3.06 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide

weather tight covering and to shed water.

- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal with the application of 1/8" bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.
- C. Install straps on 9" centers and at each circumferential lap joint.
- D. Cover and seal all exposed surfaces.
- E. The use of screws and rivets is not approved.
- F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.07 MISCELLANEOUS

- B. Install materials after piping has been tested and approved.
- C. Apply insulation on clean, dry surfaces only.
- D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.08 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Refrigerant Piping	1-1/2
Condensate Drains	1

END OF SECTION 23.07.19

SECTION 23.20.00
MECHANICAL PIPE AND FITTINGS - GENERAL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.02 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Earthwork.
 - 2. Valves, Strainers and Vents.
 - 3. Vibration Isolation.
 - 4. Insulation.
 - 5. Other Piping Sections

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.02 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
 - 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
 - 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
 - 3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

- E. Flanged.
 - 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
 - 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
 - 3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
 - 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
 - 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
 - 6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
 - 1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
 - 2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
 - 3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
 - 4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.03 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
 - 1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.04 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.05 GASKETS

- A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.06 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.07 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.01 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.

3.02 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if

used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

3.03 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.04 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.
- B. Provide supports both sides and within 12" of each horizontal elbow for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2" minimum vertical adjustment.
- F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped

galvanized.

- H. Provide hangers within 3' of pipe length from all coil connections.
- I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.05 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.06 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.07 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.08 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.09 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.10 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.11 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as

required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.

- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.
- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.
- G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.
- I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

3.12 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for

ultimate proper and satisfactory operation of piping systems and their accessories.

3.13 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION 23.20.00

SECTION 23.23.00
REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.02 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Pipe and Pipe Fittings
 - 2. Piping Insulation

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.02 SERVICE VALVES

- A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.
- B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.03 SOLENOID VALVES

- A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.
- B. Use valves with a bronze body and sweat-type connections.
- C. Provide stainless steel stem and plunger assembly and a stainless steel piston.
- D. Furnish sealed and moisture proof solenoid coils.
- E. Use electrical characteristics of 115 volt, 60 Hertz.

2.04 SIGHT GLASSES

- A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.05 FILTER DRYER

- A. Furnish replaceable core liquid line filter dryer.
- B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 - EXECUTION

3.01 BRAZING

- A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.02 PRESSURE TEST

- A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
 - 1. Test joints with a Halide torch or an electronic leak detector.
 - 2. Repair leaks and retest each system until proved tight.

3.03 EVACUATION AND DRYING

- A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
 - 1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
 - 2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.04 PIPE SIZE

- A. Pipe shall be routed and sized per condensing unit manufacturer's instructions.

END OF SECTION 23.23.00

SECTION 23.31.13
DUCTWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.02 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Devices
 - 2. Air Handling Units
 - 3. Insulation
 - 5. Fan Coil Units
 - 6. Fans
 - 8. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.03 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.04 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.05 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.06 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.
- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.
- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.01 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.02 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.

2.03 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
 - 1. Indoor applications – Foster 32-14
 - 2. Outdoor applications – Foster 32-17

2.04 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:

1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
 - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
 2. UL 181 Class I air duct label
 3. Reinforced vapor barrier jacket
 4. Rated for use at system pressure (6" wc minimum)
 5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:
1. Flame spread rating 25 maximum.
 2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
1. Flexmaster
 2. Hart & Cooley
 3. Omniair
 4. Peppertree Air Solutions

2.05 WALL LOUVERS

- A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. Acceptable manufacturers:
1. American Warming and Ventilation
 2. Arrow
 3. Greenheck
 4. NCA
 5. Pottorff
 6. Ruskin

2.06 DUCT LINING

- A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.07 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
 - 1. Frame 16-gauge
 - 2. Blades 16-gauge
 - 3. Bearings corrosion resistant
 - 4. Concealed linkage
 - 5. Opposed blade dampers
- B. Acceptable manufacturer:
 - 1. Ruskin Model MD-35 or approved equal, by
 - 2. Arrow
 - 3. American Warming and Ventilating
 - 4. Nailor Industries
 - 5. Pottoroff

2.08 ACCESS DOORS

- A. Round spin-in door of galvanized steel.
 - 1. Fire proof sealing gaskets and quick fastening locking devices
 - 2. Insulated door
 - 3. Conform to the requirements of the NFPA
 - 4. Identification and use of each access door
 - 5. UL label to match the construction in which it is installed
 - 6. Cable attached to door and outer frame
 - 7. Low leakage Access Door
- B. Acceptable Manufacturer
 - 1. Flex master, Inspector Series
 - 2. Approved Equal

2.09 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
 - 1. Conical with a base diameter two inches larger than the tap diameter.
 - 2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
 - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
 - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
 - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
 - 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
 - a. Through 8 inches: 26 gauge; Damper blade 22 gauge
 - b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
 - c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
 - d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge

4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
6. Provide the damper with a self-locking regulator and handle.
7. Provide a 2" sheet metal stand-off to extend the regulator.
8. Flex duct grip area – 2 inches behind retaining bead
9. Flex duct retaining bead – 1 inch from end
10. Conical length of at least 3 inches
11. Barrel length of at least 9 inches

2.10 AUXILIARY DRAIN PANS

- A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Install end bearing at all location where damper shaft penetrates duct wall.
- I. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.02 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
 - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
 - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.
- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
 - 1. Return air ductwork
 - 2. Outside air branch duct
 - 3. Exhaust branch duct
 - 4. Exhaust connections to hoods except kitchen grease hoods or equipment
 - 5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
 - 6. At each outside air and return air duct connection to plenum of constant volume units
 - 7. At discharge side of constant volume boxes
 - 8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
 - 9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
 - 1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a

- centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
- I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
- J. Insulated Flexible Duct:
1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
 2. Construct bends over 45° with sheet metal elbows.
- K. Duct Supports:
1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
 2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
 3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
 4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.
- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.03 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.04 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.05 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations: *Some clients want doors on both sides of dampers.
 - 1. Outside Air Dampers
 - 2. Duct Mounted Coils (up-stream)
 - 3. Control Dampers
 - 4. 12"x12" access door for cleaning at a maximum distance of 20'-0" from center of adj. access door.
- B. Size access door 1" smaller than ductwork.
 - 1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.06 DUCT LINING

- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.

- D. Do not install liner in multi-zone unit ductwork.

3.07 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

3.08 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.09 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.
- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.10 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

3.11 AUXILIARY DRAIN PANS

- A. Where coils that have a condensate drain are located above ceiling.

3.12 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times

design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.

- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

END OF SECTION 23.31.13

SECTION 23.34.16
FANS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.02 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Ductwork
 - 2. Vibration Isolation
 - 3. Air Balance
 - 4. Electrical Provisions of Mechanical Work

1.03 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.
- E. Fans shall be capable of 120% of the scheduled air capacities.
- F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.04 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Cook

- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.02 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.03 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Belt Drives:
 - 1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
 - 2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
 - 3. Provide belt guards and apply the same finish as used on the fan.
 - 4. Oil and heat resistant, nonstatic type belts.
 - 5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
- C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.

- F. Dampers. Where automatic backdraft damper is scheduled:
 - 1. Multi-bladed.
 - 2. Heavy duty.
 - 3. Roll formed aluminum blades.
 - 4. Nylon bearings.
 - 5. Neoprene weather strip on blade edge.
- G. Where motorized damper is scheduled:
 - 1. The motor and damper are specified in the Building Management and Control System Specification.
- H. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
 - 1. Fan mark as indicated on the Contract Drawings.
 - 2. Serial number
 - 3. Model number
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP
 - 6. Motor Amps
 - 7. Manufacturer
 - 8. Motor phase
 - 9. Number of Belts/Make/Size
 - 10. Motor volts

2.04 VENTILATION AND EXHAUST FANS

- A. Provide the ventilation and exhaust fans shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Provide each belt driven fan with approved, totally enclosed belt guard.
- D. Provide approved safety screen where inlet or outlet is exposed.
- E. Provide duct flanges where required for connections.
- F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- G. Furnish supply fans with 1" aluminum, washable filter section.

2.05 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Components:

1. Aluminum, stainless steel or plastic coated bird guard.
 2. Screws and fasteners of stainless steel or nonferrous material.
 3. All aluminum construction unless indicated otherwise on fan schedule.
- D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine alloy aluminum.
- E. Aluminum base shall be continuously welded curb cap corners.

2.06 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

- A. Provide the rooftop intake and relief vent systems shown on the drawings.
- B. Provide with aluminum, stainless steel or plastic coated bird guard.
1. Screws and fasteners of stainless steel or nonferrous material
 2. All aluminum construction
- C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
- D. Aluminum base shall be continuously welded curb cap corners.

2.07 OSCILLATING AIR CIRCULATOR FAN

- A. Three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
- B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
- C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
- D. Wall Mounted
- E. Factory wired 10', 3 conductor with ground molded plug
- F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.
- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted

equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x 1/4" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.

- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
 - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
 - 2. Provide sub-structure where required.
 - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.02 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23.37.13
AIR DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.02 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.

1.03 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.04 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.05 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.01 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.02 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.
- D. Price
- E. Metal-Aire

2.03 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.

Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.

- B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.

1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.02 INSTALLATION

- A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION 23.37.13

SECTION 23.41.00
AIR FILTRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install air filters.

1.02 RELATED WORK

- A. Division 23 Mechanical.

1.03 SUBMITTALS

- A. Submit manufacturer's product data sheets and capacity information as specified.
- B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.01 AIR FILTERS

- A. The filter cells:
 - 1. Disposal media and frame.
 - 2. Coated with high flash point adhesive.
- B. Resistance to air flow of a clean filter not to exceed 0.12" WG at 300 fpm.
- C. UL listed Class II rated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the filters in accordance with the manufacturer's instructions.

END OF SECTION 23.41.00

SECTION 23.63.00
AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.02 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.03 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Trane
- C. Daikin
- D. York
- E. JCI
- F. Lennox

2.02 COMPRESSOR

- A. Provide a hermetic or semi-hermetic compressor with crankcase heaters, inherently protected motors, spring mounts and capacity modulation. Provide each compressor with a 5-year warranty.
- B. Provide refrigerant not scheduled for phase out during the life of the unit.

2.03 CONDENSER COILS

- A. Provide copper tubes with mechanically bonded aluminum fins. Protect condenser coils with a heavy gauge, corrosion resistant wire guard.

- B. Provide condenser coil coated with corrosion resistant epoxy utilizing a dip and bake process. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.04 FANS AND MOTORS

- A. Provide propeller-type fans with direct drive or belt drive and vertical discharge. Protect fan with a heavy-gauge, corrosion resistant wire guard. Provide inherently protected, permanently lubricated, and weatherproof motors.

2.05 CASING

- A. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gauge steel, zinc coated and finished with enamel. Provide removable access panels.

2.06 CONTROLS

- A. Provide safety and operating controls factory wired and mounted in a separate enclosure. Include thermostatic expansion valve, high and low pressure switches and compressor motor overload devices. Furnish a time delay device to prevent short cycling. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections.

2.07 THERMOSTAT

- A. Low voltage, 7-day programmable thermostat is a component of the unit manufacturer unless specified in another Section.
 - 1. Individual Heating/Cooling setpoints.
 - 2. Automatic Heat/Cool change-over.
 - 3. Sub-Base On-Off-Auto fan selection.
 - 4. Sub-Base Heat-Off-Cool-Auto system selection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install removable core refrigerant filter dryer and sight indicating glass.

3.02 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

END OF SECTION 23.63.00

SECTION 23.73.13
AIR HANDLING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.02 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Balance
 - 2. Ductwork
 - 3. Controls
 - 4. Electrical Provisions of Mechanical Work
 - 5. Air Filtration
 - 6. Heating and Cooling Coils
 - 7. Other applicable sections

1.03 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
 - 1. Units must be certified in accordance with ARI Standard 430-66.
 - 2. UL 1995 certification for safety including electric heat.
 - 3. ARI 430 listed and meet NFPA 90A requirements.

1.04 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
 - 1. Plot fan volume against static pressure, horsepower and efficiency.
 - 2. Show point of rating based on static requirements of the system.
 - 3. Chart of specific sound power level at each octave band center frequency.
 - 4. For variable volume units, plot fan volume over entire range.
- C. Submit for review a unit internal static pressure loss calculation.
 - 1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
 - a. Coils
 - b. Dirty filters
 - c. Fan and unit system effect
 - d. Cabinet and cabinet inlet and outlet
 - e. Unit mounted dampers
 - 2. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Trane
- C. York
- D. Daikin
- E. JCI
- F. Lennox

2.02 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- D. Unit casing panels shall be a minimum of 2" double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.
- E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).

- F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.
- G. Provide factory installed removable hinged access doors in the following locations:
 - 1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
 - 2. Each side of filter compartment to allow changing of filters from either side.
 - 3. Each side of motor compartment to allow motor and isolation access.
 - 4. Each side of condensate drain pan to allow for cleaning and inspection.
 - 5. Swing the doors against the casing static pressure.
- H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
- J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.
- K. Provide units with a low velocity angled filter section unless otherwise specified.

2.03 DRAW THROUGH AIR HANDLING UNITS CONSTANT VOLUME

- A. Provided with:
 - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
 - 1. Sized for 50% overload.
- C. Motors and Control:
 - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
 - 2. Maximum operating point of 70 Hz.
 - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
 - 4. Premium efficiency inverter duty
 - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
 - 6. +/- 10% voltage utilization range to protect against voltage variation.
 - 5. Cast iron frame and end plate
 - 6. Forged steel lifting eye
 - 7. Oversized conduit box with ground lug

8. Provide with factory installed shaft grounding rings by Aegis
 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
 3. Tested after being installed in the fan sections.
 4. Selected for the design air quantities and pressure of the system.
 5. Mounted on a common shaft if multiple wheels.
 6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
 2. Smoke developed rating not higher than 50.
- J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.
- K. Filter section:

1. Constructed with substantial hinges.
 2. Neoprene gasketing.
 3. Permanent quick release latching devices.
 4. Arranged to accommodate the 2" thick filters as specified.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- O. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.
- E. All coils are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.

- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.
- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.
- N. Replace filters as required if units are used during construction.
- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

3.02 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
 - 1. Unit identification as indicated on Contract Drawings.
 - 2. Serial Number.
 - 3. Model Number.
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP.
 - 6. Unit power supply: Volts / PH / Amps.
 - 7. Supply Fan Type.
 - 8. Coil GPM and pressure drop.
 - 9. Sales Order #.
 - 10. Date unit manufactured.

END OF SECTION 23.73.13

SECTION 23.81.23
PACKAGED OUTDOOR HEAT PUMP AIR CONDITIONER WITH ENERGY RECOVERY

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install a packaged, outdoor, heat pump air conditioner as scheduled on the drawing.

1.02 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Balance
 - 2. Electrical provisions for mechanical work
 - 3. Air filtration
 - 4. Ductwork

1.03 REFERENCES

- A. UL 900 Flame Smoke Ratings
- B. National Electrical Code
- C. AHRI Standard 1060

1.04 SUBMITTALS

- A. Submit manufacturer's dimensioned product data sheets.
- B. Submit fan performance curve.
- C. Submit manufacturer's certified heat transfer data for heating and cooling coil capacity.
- D. Submit manufacturer's data on housing insulation material.
- E. Submit manufacturer's test data for UL 900 compliance of the exchanger core.

1.05 CAPACITY

- A. Refer to equipment schedule.

1.06 WARRANTY

- A. Provide a 10 year parts only warranty for the enthalpy exchanger core.
- B. Provide a 5 year parts and labor warranty for the remainder of the unit.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Aaon

2.02 COMPRESSOR

- A. Provide a thermally protected, hermetic compressor. Provide with a 5-year warranty.

2.03 EVAPORATOR AND CONDENSER COILS

- A. Provide copper tubes with mechanically bonded aluminum fins for evaporator and condenser coils.
- B. Provide hail guards for condenser coils.

2.04 EVAPORATOR FANS

- A. Provide a direct-drive, forward-curved, centrifugal evaporator fan. Motor shall contain permanently lubricated bearings.

2.05 AUXILIARY ELECTRIC HEATER

- A. Provide heavy duty electric heating elements with circuit breakers or fuses and automatic reset-limiting control and heat limiters. Provide open wire nichrome elements with all necessary safety and operating controls. Provide single power entry by terminal blocks.

2.06 CASING FILTERS AND DUCT CONNECTION

- A. Provide a cabinet constructed of galvanized or zinc-coated steel, primed and coated with baked enamel.
 - 1. Color selection by Architect.
- B. Provide manually operated outdoor air dampers and counterbalanced return air damper.
- C. Furnish filters as specified.

2.07 OUTDOOR FAN

- A. Provide direct drive, forward curved, centrifugal fan. Motor shall contain permanently lubricated bearings.

2.08 CONTROLS

- A. Controls are specified in Section 23 09 33.
 - 1. Coordinate requirements.

2.09 UNIT HOUSING

- A. Construct the unit housing of 16 gauge galvanized steel sheets.
 - 1. Unitized structural steel frame and base with gusseted corners.
 - 2. Braced and of sufficient strength to prevent "breathing".
 - 3. Construct to accommodate the weight of a 250 lb. man at any location on the top.
 - 4. Completely weatherproof and sloped for drainage.
 - 5. Make casing joints water tight with approved sealant.
- B. Units shall have double wall construction throughout the unit. Casing panels on units casing panels must be a minimum of 18-gauge galvanized steel for the interior panel. Provide gasketing around the perimeter of all panels to assure air-tight integrity.
- C. Fan assembly shall be provided with 1-inch deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2-inch deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge.
- D. Provide factory installed full size, gasketed, removable, hinged access doors in the following locations:
 - 1. Entering side of all coils to allow for cleaning of coils on both side of unit.
 - 2. Each side of filter compartment to allow changing of filters from either side.
 - 3. Each side of motor compartment to allow motor and isolation access.
 - 4. Each side of condensate drain pan to allow for cleaning and inspection.
- E. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- F. Provide coils with stainless steel casings, end plates, tube supports and top and bottom plates.
- G. Provide doors for motor and filter compartments with door swing away from piping connections.
- H. Exterior of unit shall be weatherproof and shall pass a 500-hour salt spray test.

- I. Use stainless steel fasteners with stainless steel piano hinges; latches with zinc plated, epoxy coated T-bar handles; and air tight gaskets.
- J. Insulate the unit with a minimum of 2-inch closed cell 3 lb. density, neoprene coated, fiberglass insulation.
 - 1. Coat all exposed cut insulation edges with mastic.
 - 2. Flame spread not higher than 25.
 - 3. Smoke developed rating not higher than 50.
 - 4. Insulation shall be thick enough to prevent sweating at 95°F dry bulb / 80°F wet bulb. Condensation on exterior of the air handling unit is not approved.
- K. Provide outside air damper and outside air hood component. A motorized outside air damper actuator shall be provided in the Building Management and Controls specification.
 - 1. Storm proof louvers
 - 2. Outside air dampers as specified

2.10 HEAT EXCHANGER

- A. Element shall be rated by manufacturer using method described in ASHRAE Standard 84-1991 Procedure for Testing Air-to Air Heat Exchangers.
- B. Element shall be certified by AHRI within the AHRI Standard 1060 Certification Program. Heat exchanger shall have no moving parts and include nano-scaled polymer membrane with no paper or surface mounted desiccants.
- C. Element shall provide sensible and latent transfer between the airstreams. The transfer shall be accomplished by moving sensible and latent energies molecularly through the enthalpy exchanger surface while keeping the airstreams physically separated.
- D. Energy transfer media shall be resistant to transfer of pollutants between air streams. At rated airflow smoke transfer shall be 2% or less, and carbon dioxide transfer shall be 4.5% or less.
- E. The unit shall be capable of both summer and winter operation without any condensation management requirements.
- F. Heat Exchange Media:
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.

PART 3 - EXECUTION

3.01 INSTALLATION

- B. Install according to manufacturer's recommendations and as shown on drawings.
- C. Install unit so motor connections and filters are accessible.

3.02 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

END OF SECTION 23.81.23

SECTION 23.82.16
HEATING AND COOLING COILS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install heating and cooling coils.

1.02 SUBMITTALS

- A. Submit manufacturer's product data sheets and unit capacity information as specified.

1.03 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Air Handling Units.
 - 2. Fan Coil Units.
 - 3. Ductwork.

PART 2 - PRODUCTS

2.01 DIRECT EXPANSION COOLING COILS

- A. DX cooling coils:
 - 1. Constructed of copper tubes and aluminum fins.
 - 2. Designed and circuited for use with direct expansion refrigeration.
- B. Cooling coil face velocity:
 - 1. Not of magnitude to cause moisture to be carried off the coil.
 - 2. Maximum velocity as scheduled.
- C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.02 ELECTRIC HEATERS

- A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
- B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.
- C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic

bushings. All terminal hardware shall be stainless steel.

- D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
- E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
- F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
- G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.
- H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION 23.82.16

SECTION 23.82.39
ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install electric unit heaters complete with heating element, propeller mounting brackets and other options as specified.

1.02 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Ductwork.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Modine
- B. Reznor
- C. Chromalox
- D. Trane
- E. Markel

2.02 COMPONENTS

- A. Casing:
 - 1. Construct casing of sheetmetal with a structural frame.
 - 2. Enamel or lacquer finish to manufacturers standard.
- B. Electric Heating Elements:
 - 1. Shall bear the UL label.
 - 2. Corrosion resistant materials.
 - 3. Heating coil of 80-20 nickel-chrome wire.
- C. Components:
 - 1. Fused control circuits
 - 2. Contactors in accordance with the staging requirements
 - 3. Control power transformer
 - 4. Control voltage 120
- D. Louvers:
 - 1. Adjustable vertical and horizontal louvers for air discharge.
- E. Mounting brackets:

1. As indicated

2.03 CONTROLS

- A. Automatic controls:
 1. Factory mounted
 2. Prewired to the junction box
 3. Unit mounted thermostats 24-volt low voltage
- B. Safety Controls:
 1. A primary and secondary thermal cut-off to de-energize each circuit.
 2. Manual reset high limit
 3. Automatic reset thermal protection

2.04 FAN

- A. Propeller blade fan:
 1. Construct the fan of aluminum or other corrosion-resistant material.
 2. Statically and dynamically balanced
 3. Substantial fan guard

2.05 MOTOR

- A. Totally enclosed ball bearing motor:
 1. Permanently lubricated bearings
 2. 120 volt, single phase, 60 cycle motor
 3. Sized to operate the fan at the required capacity

2.06 ELECTRICAL

- A. Single point connection:
 1. Factory wiring
 2. Only direct line supply and thermostat field connections
 3. Terminal blocks for line voltage wiring
 4. Wiring diagram permanently attached
 5. Balance phases

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Furnish units with suitable connections for mounting as shown or as otherwise approved.
- B. Provide start-up to ensure correct operation of unit.
- C. Adjust discharge louvers to control direction of air flow.

END OF SECTION 23.82.39

SECTION 26.01.05
ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.02 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Lamps, Light Engines
 - 12. Schedule of Ballasts and Drivers
 - 13. Schedule of Fuses
 - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the (3) completed manuals in final form to the Architect / Engineer.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall

be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

- F. Three complete manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.01 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1".
 - 1. Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.01 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement

- d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Summer and winter operating instructions
 - 4) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Servicing and lubrication schedule
 - 1) List of lubricants required
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from

- the drawings).
- 1) Electrical
- 2) Controls
- 3) Communications
- g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear
 - 2) Items recommended to be stocked as spare parts
- h. Schedule of fuses
- i. Complete equipment field accessible internal wiring diagrams
- j. Schedule of lamps
- k. Schedule of ballasts
- l. Each Contractor's coordination drawings
- m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
- n. Other data as required under pertinent sections of the specifications
- 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
- 4. Provide complete information for products specified in Division 26.
- 5. Provide certificates of compliance as specified in each related section.
- 6. Provide start up reports as specified in each related section.
- 7. Provide signed receipts for spare parts and material.
- 8. Provide training report and certificates.

END OF SECTION 26.01.05

SECTION 26.05.00
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.02 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Electrical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department adopted codes with amendments
 - 5. National Electrical Code with local amendments
 - 6. State Regulatory Agencies
 - 7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
 - 8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
 - 9. International Energy Conservation Code
 - 10. National Electrical Safety Code
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.03 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.

2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.04 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.
- B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
 1. Underwriters Laboratories, Inc. (UL)
 2. Factory Mutual Research Corp. (FMRC) (also referred to as "Factory Mutual Global," or "FM Global")
 3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
 4. Canadian Standards Association (CSA)
 5. A complete listing of acceptable NRTLs is published on the OSHA website at <http://www.osha.gov/dts/otpca/nrtl/>.
- C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.
- D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner's AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.
- E. Codes and Standards applicable to this Division:
 1. ANSI – American National Standards Institute
 2. ASTM – American Society for Testing and Materials
 3. CBM – Certified Ballast Manufacturers
 4. ICC – International Code Council
 - a. International Building Code® (IBC)
 - b. International Existing Building Code® (IEBC)
 5. ICEA – Insulated Cable Engineers Association
 6. IEEE® - Institute of Electronics and Electrical Engineers
 7. IESNA – Illuminating Engineering Society of North America
 8. NECA – National Electrical Contractors Association:
 9. NEMA – National Electrical Manufacturers Association
 10. NETA – International Electrical Testing Association, Inc.:

11. NFPA – National Fire Protection Association:
 - a. NFPA 70™, *National Electrical Code® (NEC®)*
 - b. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
 - c. NFPA 101®, *Life Safety Code®*
 - d. NFPA 110, *Standard for Emergency and Standby Power Systems*
12. OSHA – Occupational Safety and Health Administration
13. IECC – International Energy Conservation Code
14. ISO – International Organization for Standardization
15. Applicable County and Municipal Codes

1.05 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.
- C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.
- D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.
- E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon

completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

- B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
 3. Three sets of blue-line prints of each contract as-built drawing.
 4. Three sets of pdf prints of each contract as-built drawing on CD.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's Seal, name, address, and logo from drawings.
 3. Mark documents RECORD DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY:
 5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
 6. Indicate exact location of all underground electrical raceways, and elevations.
 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
 10. Exact location of all electrical equipment in and outside of the building.
 11. Exact location of all outdoor lighting poles and equipment.
 12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
 13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 14. Cloud all changes.
 15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.07 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.08 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
 - 1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
 - 2. The responsibility for alignment of motor and driven equipment is specified in the related division.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.09 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
 - 1. Obtained from utility maps and other substantially reliable sources.
 - 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

- A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

- A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.
- B. Manufacturer's warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.
- C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
 - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.

2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
 - a. Utility Power: White letters on black background
Generator Power (White letters on red background)
 - b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "PANEL HA –fed from MDP-6 located in Mech. Rm. 100"). The words "fed from" and "located" shall be included in the labeling.
 - c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in 1/4-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
 - d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel "HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100")
 - e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
 - f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1	Receptacle Contactor C2
West Parking Lot Pole Lights	Table Recpts Lab Rm 100
Fed From Panel HA-2,4,6	Fed From Panel LA-2,4,6,8
Located Main Elec. Rm. 100	Located Mech. Rm. 110
Control Circuit-Panel LA 42	Control Circuit-Panel LA-42
Located Main Elec. Rm. 100	Controlled-Emer Shut Off Mushroom
Controlled-BMCS	Switch Rm 101

- g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A

- h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.
- i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e. TLA.
- j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.
 - 1. Main Service ATS Example Wall Mounted Lighting ATS Example
 - i. ATS-1 ATS
 - 2. Emer Power-Emer Generator Exterior Wall Packs/Soffit Lights
 - 3. Located Chiller Yard North/West Metal Canopy Lights
 - 4. Normal Power-MSB Fed from EHA-2
 - 5. Located-Mech Rm 100 Located Mech Rm 200
 - 6. Serves Panel EHA Fed From HB-4
 - 7. Located-Mech Rm 100 Located Mech Rm 150
 - 8. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
 - 9. Service equipment available fault current labeling: Provide a 2x3 inch label with blue lettering on contrasting background permanently affixed to the service disconnect/equipment prior to energizing the service equipment. The label shall include the date of installation and the date of calculation. The date of calculation shall be the date indicated by the Engineer of Record’s Seal on the Construction Document Electrical One-Line Diagram / Riser Drawing. Example:

SERVICE EQUIPMENT AVAILABLE FAULT CURRENT: ##, ###
AMPS

DATE OF INSTALLATION: MM/DD/YY

DATE OF CALCULATION: MM/DD/YY

- k. Above ceiling lighting control relay equipment: Provide name plate glued to bottom of ceiling T-grid below relay location. White letters on black background with ¼” high letters on ½” tall label for digital lighting module “DLM”.
3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit

descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as “corridors”. Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect’s final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.

4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
 5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner’s motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.
- B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.
- E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer’s shop drawings for control wiring.
- F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines

and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.

3.02 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.03 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
 - 3. Refer to other specification sections for additional training and commissioning requirements.
- B. Time to be allocated for instructions.
 - 1. Minimum of 20 hours dedicated instructor time
 - 2. 4 hours on each of 5 days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.04 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.05 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
- C. Concrete pads:
 - 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
 - 5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.06 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.07 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.08 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.09 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

- A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
 - 1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
 - 2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
 - 3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer's minimum circuit conductors, at no additional cost to the Owner.
 - 4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
 - 5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer's maximum recommendations.

3.10 FAULT CURRENT AND OVERCURRENT DEVICE COORDINATION AND ARC FLASH STUDY

- A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or

provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.

- B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.
- C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.
 - 1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.
- D. Information to be determined and applied to electrical equipment:
 - 1. Arc-Flash Protection Boundary
 - 2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 TM
 - 3. Working distance calculated in accordance with IEEE Std 1584a TM
 - 4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
 - a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
 - 5. System phase-to-phase voltage
 - 6. Condition(s) when a shock hazard exists (e.g. "With cover off")
 - 7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 10. Unique equipment designation or code (described under "Component Identification")
 - 11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
 - 12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
 - 13. Date that the hazard analysis was performed.
 - 14. "Served from" circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
 - 15. If applicable, the "serves" circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.

16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584aTM, paragraph 9.2.3.
 17. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.
- E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 TESTING

- A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.
- B. The project will not be declared substantially complete until the following has taken place.
1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
 2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
 3. Occupancy Sensor and Lighting Controls
 4. Surge protective device equipment
 5. Overcurrent devices
 6. Motor Controllers
 7. Emergency Lighting
 8. Building Fire Alarm System
 9. Clock System
 10. Television Distribution System
 11. Building Data / Voice Cabling System
 12. Surveillance and Security System
 13. Intercom / Telephone
 14. Sound Reinforcement Systems
 15. Building Lightning protection System

END OF SECTION 26.05.00

SECTION 26.05.05
ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.02 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.03 CONTRACT DRAWINGS

- A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or

operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

- C. Verify field measurements and circuiting arrangements.
- D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
- F. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.02 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminaire that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures
- C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Panelboards Reused and Modified for Renovation: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.03 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- C. Prior to shutdown of existing power for any single extended period of time greater than 18 hours, provide at minimum 120/240 volt, 1-phase, 3-wire electrical service to provide temporary power to all critical loads as identified by Owner including but not limited to all security systems, fire alarm panel and associated remote power supplies. Contractor shall provide continuous operation temporary generator power or coordinate directly with local utility regarding temporary power service and metering and provide all necessary permits and fees at no cost to the Owner.
- D. Provide a minimum 30 space panelboard with required branch circuit breakers as required and all associated temporary wiring as required. Remove all temporary power prior to substantial completion.
- E. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.
- F. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.
- G. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
 - 1. Remove exposed conduit that has been abandoned.
 - 2. Cap conduit beyond the finish line.
 - 3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.
- H. Where new/existing luminaries or devices are shown being connected to existing circuits:
 - 1. Field verify existing system voltage
 - 2. Provide ballast / device to match system voltage
- I. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.
- J. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box

serving load to remain, or back to panel if not serving remaining load.

- K. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- L. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- M. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- N. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- O. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- P. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- Q. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- R. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- S. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

3.04 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the following:
 - a. Equipment is removed or relocated
 - b. Fixtures are removed or relocated
 - c. System is no longer used
 - d. There is no demonstrable near term future use for the existing circuit or raceway system.
 2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
 - a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
 - b. Removal is not feasible due to hazards, construction methods, or restricted access.
 - c. Removal of abandoned conductors may damage conductors that must remain operational.
 3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.
 4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
 5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
 6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- K. Existing conduit raceway found to need additional hangers installed and/or junction box covers shall be added at no additional cost to the Owner.
- L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.05 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.06 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description "existing". Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.07 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Pre-construction testing of existing low voltage systems:
 - 1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
 - a. Paging System.
 - b. Telephone System
 - c. Fire Alarm System
 - d. Data Network Communications System
 - e. Video Distribution System
 - f. Security Access Control System
 - g. Video Surveillance System.
 - h. Sound Reinforcement System
 - 1. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.
- B. Substantial completion testing of existing low voltage systems:
 - 1. Provide complete operational tests of the following systems within 14-days prior to estimated date of substantial completion. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians each certified by the respective manufacturer of the existing system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system

shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:

- a. Paging System.
 - b. Telephone System
 - c. Fire Alarm System
 - d. Data Network Communications System
 - e. Video Distribution System
 - f. Security Access Control System
 - g. Video Surveillance System.
 - h. Sound Reinforcement System
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and each individual performing the tests. Provide the written report within 14 days of expected date for substantial completion.
- C. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
1. Notify the Owner immediately of any disruption or damage to any low voltage system.
 2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
 3. For each low voltage system other than access control or fire alarm system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
 4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION 26.05.05

SECTION 26.05.09
ELECTRIC UTILITY COORDINATION AND SERVICE ENTRANCE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. General: Electrical service shall be provided by local utility company.
- B. Power Company Data: Obtain from utility company information and installation standards for electrical service installation.
- C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Service Data: Ensure that utility company service data is accurate and verified.

2.02 PRIMARY SERVICE

- A. General: Division 26 shall provide primary service conduit, concrete transformer pads, concrete ductbank, manholes, and pull boxes as required and as specified.
- B. Utility company shall provide primary cables, splices, terminations, and primary underground and overhead service conductors.

2.03 TRANSFORMERS AND SWITCHGEAR

- A. General: Division 26 shall make provisions for service as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, and sleeves.
- B. The utility company shall provide service transformers, primary switchgear, primary protective relaying, and connections to the customer service.

2.04 SECONDARY SERVICE CONDUCTORS

- A. General: Division 26 shall provide secondary service entrance conductors, conduit and concrete ductbank.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.

- B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.
- C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.
- D. The materials and labor required by the for a complete installation shall be provided by the contractor and includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, metering racks and metering enclosures.
- E. Utility distribution poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by the Contractor to verify their proper placement is within the Owner's property and respective utility easements. Contractor shall verify by survey that the pole and service entrance ductbank location and easements do not interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.
- F. Contractor shall initiate contact with the power provider (retail seller), utility (transmission and distribution), and Owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION 26.05.09

SECTION 26.05.10
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.02 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.03 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.04 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.05 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.06 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide manufacturer's qualified personnel to observe:
 - 1. Field conditions
 - 2. Condition of installation

3. Quality of workmanship
4. Start-up of equipment
5. Testing, adjusting, and balancing of equipment

- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIAL

- A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

PART 3 - EXECUTION

3.01 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.
- B. Coordination Drawings:
1. Electrical room size and location required and to scale
 2. Equipment and accessories, switchgear and piping
 3. Indicate clearances and service access.

3.02 ELECTRICAL ACCEPTANCE TESTING

- A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification* (ATS).
- B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
1. Installed in accordance with design documents and manufacturer's instructions.
 2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
 3. Ready to be energized.
 4. Operational within industry and manufacturer's tolerances.

3.03 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

- A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

END OF SECTION 26.05.10

SECTION 26.05.12
SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.02 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.03 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SPECIFICATION COMPLIANCE REVIEW

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

3.02 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submittal Specification Information:
 - 1. Every submittal document shall bear the following information as used in the project manual:
 - a. The related specification section number
 - b. The exact specification section title
 - 2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
- C. Submit individually bound shop drawings and product data for the following when specified or provided. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other switchgear.
 - 1. Fault Current and Overcurrent Device Coordination Analysis.
 - 2. Enclosed Switches and Circuit Breakers
 - 3. Enclosed Motor Controllers
 - 4. Panelboards and enclosures
 - 5. Wiring devices
 - 6. Electrical controls and time switches
 - 7. Lighting fixtures
 - 8. Site Lighting Poles, Fixtures, Ballast, Drivers, and Lamps
 - 9. Architectural Dimming Systems
 - 10. Surge Protection Devices
 - 11. Electrical Contactors
 - 12. Lighting Controls and Occupancy Sensors
 - 13. Transformers
 - 14. Theatrical Lighting Systems
 - 15. Emergency/Standby generator sets and transfer switches

3.03 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

3.04 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name; identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing major electrical switchgear and each outside equipment pad with major electrical switchgear and equipment, submit plan and elevation drawings. Show:
 - 1. Actual electrical switchgear, equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components provided by other trades, ductwork, piping, air-handling equipment, etc., and openings, doors and obstructions. Drawings shall include an overlay of other systems demonstrating coordination and clearances.
 - 4. Housekeeping pad location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of wiring devices, telephone outlets and other work specified in this Division.
 - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.

3.05 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

3.06 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

3.07 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes

- I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.
- J. Contractor's Stamp of Approval
 - 1. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
 - 2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
 - 3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
 - 4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

3.08 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions.
 - 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer, and/or electronic data (pdf) files.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name, address and telephone number
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier

- d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
- 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 - 2. Associated items requiring correlation for efficient function or for installation

3.09 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
 - 1. Indicate that the document or sample is a resubmittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

END OF SECTION 26.05.12

SECTION 26.05.19
CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown, and specified.
- B. Types: The types of conductors and connectors required for the project include the following:
 - 1. 600V building conductors
 - 2. 600V building conductor connectors
- C. Application: The applications for conductors and connectors required on the project are as follows:
 - 1. Power distribution circuitry
 - 2. Lighting branch circuitry
 - 3. Appliance, receptacle, and equipment branch circuitry
 - 4. Motor branch circuitry
 - 5. Control wiring
 - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.02 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.03 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
 - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
 - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B

meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.

- C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
 - 1. All wiring inside lighting fixtures shall be temperature rated per NEC.
 - 2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.
- D. Cable Lubricant: Fire resistant, nonflammable, water based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

2.02 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

- 1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
- 2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
- 3. Conductors shall be the same color from breaker to device or outlet.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.

C. Conductors:

1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
9. Provide the same size wire from the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
12. Support conductors in vertical raceways, as required by the NEC.
13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor

- shall be identified with green phasing tape at all accessible locations.
 - 20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
 - 21. Clean conductor surfaces before installing lugs and connectors.
 - 22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
 - 24. Run mains and feeders their entire length in continuous pieces without splices or joints.
 - 25. Color code conductors.
 - 26. Do not install a pull string in conduits containing conductors.
 - 27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
 - 28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.
- D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- E. Splices and Joints:
- 1. In accordance with UL 486A, C, D, E, and NEC.
 - 2. Aboveground Circuits (No. 10 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
- F. Aboveground Circuits (No. 8 AWG and larger):
- 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
 - 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
 - 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
 - 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- G. Underground Branch Circuits and Feeders:
- 1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

3.02 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.
- B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
- C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.
- D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

END OF SECTION 26.05.19

SECTION 26.05.26
ELECTRICAL GROUNDING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code.
 - 2. Governing local codes.
 - 3. All Local Utility Companies
- B. Ground effectively and permanently.
 - 1. Neutral conductor at the main service disconnect and other separately derived systems.
 - 2. All conduit systems.
 - 3. All electrical equipment and related current carrying supports or structures.
 - 4. All metal piping systems.
 - 5. All building structural metal frames.
 - 6. All telephone/voice/video/CATV/data utilities

1.02 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. Cadweld
- C. Burndy
- D. O. Z Gedney
- E. Crouse-Hinds

F. B-Line

2.02 GROUNDING ELECTRODES

- A. Driven Rod Electrode
 1. 3/4" x 10'-0" copper clad grounding electrode.
 2. UL listed.
 3. Approved thermal fusion connector methods (exothermic).
- B. Metal frame of building or enclosure.
- C. Foundation concrete encased rebar.

2.03 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

- A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.
- B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.
- C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.04 EXOTHERMIC CONNECTIONS

- A. Exothermic type for underground and structural steel; Cadweld
- B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.05 WIRE

- A. Stranded, copper cable
- B. Foundation Electrodes: 4/0 AWG
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 - EXECUTION

3.01 GROUNDING AND BONDING

- A. In the service equipment, provide a separate (dedicated) ground bus.
 1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
 2. Resistance of neutral to ground shall not exceed 10 Ohms.
 3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground loop.

4. Provide grounding and bonding at the power company's metering equipment.
 5. Provide access and cover for access to the ground grid and removable connections for testing the system.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
1. In rigid PVC conduit.
 2. Provide thermo fusion connection for each rod ground electrode.
 - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
 - b. Install rod electrodes as required. Install additional rod electrodes as required to achieve specified resistance to ground.
 - c. The minimum distance between driven ground rod electrodes shall be 10'.
 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and 25 Ohms for equipment grounds.
 - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
- C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.
- D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.
- E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.
- F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- G. Provide bonding to meet Regulatory Requirements.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.
- L. Do not use powder-actuated anchors.

- M. Do not drill or cut structural members.
- N. Do not use compression or mechanical connectors underground.
- O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.

3.02 METAL FRAME OF BUILDING OR STRUCTURE

- A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.03 UFER GROUND

- A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.04 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.
- B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Exterior Electrical Equipment Racks:
 - 1. Provide driven ground electrode.
- E. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
 - 1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the nearest electrical switchboard or panelboard.
 - 2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood

- backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
 3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
 4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
 5. Bond each equipment rack, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
 6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.
 7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.
- F. Ground lighting fixture bodies to the conduit grounding system.
- G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.
- H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- I. Provide OZ Type “BJ” bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.
- J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.
- K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground loop if a ground loop is installed or the nearest structural steel member.
- L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handling units, pumps and flexible duct connections.
- M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.
- N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.

3.05 MANHOLE AND/OR PULL BOX GROUNDING

- A. Provide a driven ground rod and ground bond loop in each power and telephone manhole or pull box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground loop.

3.06 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.07 TESTING

- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
 - 1. Inspect and test in accordance with NETA ATS except Section 4
 - 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13
- B. True Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.
- C. Two-Point Bonding Measurements: The Two-point Bonding test should be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 Ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION 26.05.26

SECTION 26.05.33
CONDUIT SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Raceways and Fittings unless otherwise indicated:
1. Allied
 2. International Metal Hose
 3. Ipex
 4. Heritage Plastics
 5. Wheatland
 6. Can-Tex
 7. North American Pipe
 8. Anamet, Inc.
 9. Electri-Flex Co.
 10. Western Tube and Conduit
- B. Stainless Steel Conduit and Fittings:
1. Calbrite
 2. Gibson
- C. Aluminum Conduit and Fittings:
1. American Conduit/Sapa
 2. Wheatland
 3. Patriot Aluminum Products
- D. Condulets and Conduit Bodies unless otherwise indicated:
1. Appleton
 2. Form 85
- E. Stainless Steel Condulets and Conduit Bodies:
1. Calbrite
 2. Gibson
 3. Crouse Hinds
- F. MC Cable
1. AFC
 2. Southwire
 3. General Cable
 4. Kaf-Tech

2.02 PROHIBITED PRODUCTS

- A. Prohibited Products
 - 1. BX cable
 - 2. AC cable
 - 3. Electrical nonmetallic tubing (ENT)
 - 4. Flexible polyethylene or PVC tubing
 - 5. Intermediate Metal Conduit (IMC)

2.03 RIGID METAL CONDUIT (RMC)

- A. Schedule 40 conduit and fittings:
 - 1. Galvanized Conduit - Mild steel pipe, Zinc coated inside and out
 - 2. Aluminum Conduit - Aluminum Alloy 6063, T-1 temper
 - 3. Threaded ends and fittings
 - 4. Insulated bushings

2.04 ELECTRICAL METALLIC TUBING (EMT)

- A. Metallic Tubing
 - 1. Zinc Coated Steel - Cold rolled steel tubing, Zinc coated inside and out
 - 2. Aluminum - Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
 - 1. Full Compression Fittings
 - 2. Insulated throat connectors
- C. Prohibited Products
 - 1. Cast metal fittings
 - 2. Uni-couple type connectors
 - 3. Split ring, anti-short bushings

2.05 FLEXIBLE CONDUIT

- A. Steel flexible metallic conduit:
 - 1. Zinc coated inside and out
 - 2. 18-inches minimum length, 24-inches maximum length
 - 3. 18 inches minimum length; 6 feet maximum length for light fixture whips only
- B. Liquid tight flexible steel conduit
 - 1. Type L.A. - Grounded
 - 2. 18-inches minimum length, 24-inches maximum length

2.06 PVC CONDUIT

- A. Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. PVC elbows and fittings, except for threaded/slip-on/glue or straight conduit slip-on /

glue fittings, shall not be used on this project.

2.07 CONDULETS AND CONDUIT BODIES

- A. Form 85
- B. PVC Coated: Form 8
- C. LBC Condulets shall be used for size 2 inch and above. LL and LR Condulets shall not be used for 2 inch and above

2.08 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- A. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.
- B. Acceptable Manufacturer:
 - 1. Portable Pipe Hangers
 - 2. Cooper B-Line C-Port
 - 3. Miro Industries Models 2.5, 2.5-5, 2.5-AH, 12-AH, 16-AH

2.09 STAINLESS STEEL CONDUIT

- A. Rigid Conduit, Fittings and Supports:
 - 1. Type 304 Stainless Steel
 - 2. Threaded ends
 - 3. Insulated Bushings
- B. EMT, fittings and Supports:
 - 1. Type 304 Stainless Steel
 - 2. Compression Fittings
 - 3. Insulated Bushings

2.10 METAL CLAD (MC) CABLE

- A. Minimum conductor size shall be #12 AWG. All conductors shall be stranded copper.
- B. All MC Cable shall have an insulated ground conductor.
- C. Armor: An aluminum, or zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with Section 13 of UL 1569.
- D. Fittings shall be UL listed and identified as MCI-A for such use with metal clad interlocking armor ground. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC or MCI-A Cable to box.

2.11 EXTERIOR IN-GRADE PULL BOXES

- A. Hubbell CDR 30x48 inch minimum, provide larger size as required by conduit size or

quantity:

1. Tier 22 rated traffic duty
2. Conduit entry knock-outs as required
3. Bolt down cover
4. Integral or separate bottom
5. Adjust to grade option
6. Extension as required for specified conduit depth

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless otherwise indicated.
- B. Minimum Size Conduit:
 1. 0.5-inch unless otherwise indicated
 2. (2) 1-inch for low voltage systems unless otherwise indicated
 3. 2-inch between buildings unless otherwise indicated
- C. Provide separate raceway systems for each of the following when specified, indicated or required:
 1. 120/208 volt circuits
 2. 277/480 volt circuits
 3. Emergency
 4. Life safety branch
 5. Critical branch
 6. Equipment branch
 7. Voice/Data
 8. Sound reinforcement
 9. Theatrical and Architectural Dimming Controls
 10. MATV/CATV
 11. Security CCTV
 12. Security System
 13. Communications / PA Systems / Sound System Line Input and Speakers
 14. Fire Alarm
 15. Lighting and Building Management Control Systems
- D. Maintain 13-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- E. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- F. Use conduit hubs to fasten conduit to sides and tops of electrical equipment, device, box, gutter, wireway, disconnect, etc. in damp and wet locations.
- G. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- H. Do not use no-thread couplings and connectors for galvanized steel or aluminum rigid conduit.
- I. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper

distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.

- J. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
 - 1. Insulated throat connectors for EMT conduits.
 - 2. Insulated bushing on all rigid conduit terminations.
 - 3. Locknuts inside and outside of all boxes and enclosures.
 - 4. Threaded type plastic bushing at all boxes and enclosures.
- K. All boxes are to be accessible after completion of construction.
- L. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.
- M. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- N. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- O. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting.
- P. Make up threaded joints of conduit carefully in a manner to ensure a tight joint.
- Q. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing.
- R. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas.
- S. Install one 2-inch diameter conduit nipple between multi-sectional panels independent of feeder conductors.
- T. Prohibited Installations unless noted otherwise
- U. Do not route on floors, paved areas or grade.
- V. Do not Obstruct Equipment Manufacturer's Recommended Service Space or access to that location
- W. Where aluminum alloy conductors are specified, approved and substituted for copper conductors, provide the required conduit size based on conduit fill using NEC or recognized cable manufacturer's conduit fill tables for aluminum alloy compact conductors.

3.02 INTERIOR ABOVE GRADE INSTALLATION

- A. Conduit Types
 - 1. Concealed Conduits:
 - a. EMT
 - 2. Exposed conduits in Equipment Rooms:
 - a. EMT
 - b. RGC when installed below 18-inches above finished floor.
 - 3. Exposed conduits:

- a. RGC:
 - i. Below 9-feet AFF
 - b. Aluminum rigid conduit
 - 4. Wet Location
 - a. Aluminum rigid conduit
 - 5. Damp Location
 - a. Aluminum rigid conduit
 - 6. Conduit in concrete walls, floor or roof slab:
 - a. RGC
 - 7. Conduit elbows and rises through the slab or foundation
 - a. RGC
- B. Maintain head room and present neat appearance.
- C. Minimum 6-inches clear of bottom of roof deck.
- D. Perpendicular or parallel to building lines.
- E. Where a piece of equipment is connected from a switch or box on adjacent wall, the conduit shall go up the wall from the box, across, and back down to the equipment.
- F. Conceal conduit systems in finished areas.
- G. Conduit may be exposed in exposed mechanical and electrical rooms or where otherwise indicated.
- H. Prohibited Installations
- 1. Do not block walkways

3.03 LIGHT FIXTURE WHIPS

- A. Flexible conduit or MC cable used for lighting fixture connection shall be supported from the structure with #13 AWG galvanized iron wire pendants and "Caddy clips".
- B. Each light fixture shall have its own fixture whip from junction box.
- C. Light Fixtures installed end to end or recessed in non-accessible ceilings may connected use chase nipples.
- D. Prohibited installation:
 - 1. Do not install "Daisy Chain" light fixtures installed above accessible ceilings.

3.04 BELOW GRADE INSTALLATION

- A. Conduit Type:
 - 1. PVC
 - 2. Rigid Galvanized Conduit (RGC) for transitional bends and rises from underground PVC conduit up to 18" above grade when passing through a slab or foundation, or when subject to physical damage
- B. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- C. Conduit for all floor boxes shall be routed below building slab from floor box to nearest

column, wall, or as indicated.

- D. Changes in direction of underground conduit runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet and a maximum arc of 22.5 degrees.
- E. Provide conduit spacers for parallel branch/feeder conduits. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during concrete placement.
- F. Conduit below building slab shall be installed minimum 18-inches below finished floor and in select fill.
- G. Electrical feeder conduits, telecommunications tie, trunk, or service cable conduits shall be installed minimum 48-inches below finished floor and in select fill.
- H. Electrical service primary shall comply with the respective utility company requirements and standards.
- I. Provide two "caution" plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement.
- J. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill.
- K. As each section of the underground conduit is completed, a testing mandrel with diameter $\frac{1}{4}$ -inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
- L. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways.
- M. Conduit for 120V and above shall be separated from control and signal conduits by a minimum of 3-inches.
- N. Prohibited Installation.
 - 1. Unless shown otherwise, do not install conduit horizontally in concrete slabs.

3.05 EXTERIOR ABOVE GRADE INSTALLATION

- A. Conduit Type:
 - 1. Aluminum Rigid Conduit
 - 2. RGC where subject to physical damage or where located less than four feet above finished floor, grade or pavement.
- B. Conduit for mechanical / plumbing equipment shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.

3.06 ABOVE ROOF INSTALLATION AND ROOF PENETRATION

- A. Where specifically indicated to be routed or mounted on the roof, installation shall be as specified, recommended by roofing manufacturer, recommended by roof support manufacturer and as required by NEC.
- B. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing.
- C. Conduit for equipment mounted on roof curbs shall be routed through the roof curb.
- D. Prohibited Installations:
 - 1. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise.
 - 2. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.

3.07 CORROSIVE LOCATION CONDUIT AND FITTINGS INSTALLATION

- A. Corrosive locations are, including but not limited to, cooling towers, natatoriums, therapeutic pool areas, greenhouses, water treatment rooms.
- B. Underground conduit shall be as specified in this section.
- C. Exterior conduits and boxes within 100 feet of exhaust openings shall be stainless steel.
- D. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms) and greenhouses shall be Schedule 80 PVC. Boxes shall be PVC or 304 Stainless Steel.
- E. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.

3.08 CLASSIFIED HAZARDOUS LOCATION CONDUIT AND FITTINGS INSTALLATION

- A. UL listed for the hazard classification
- B. Underground conduit shall be as specified in this section.

3.09 CONDUIT SUPPORTS

- A. Fasten conduit supports to building structure and surfaces;
- B. Support with malleable iron conduit clamps or on conduit racks at intervals as required by NEC
- C. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Channel supports shall have cut ends filed smooth

- D. Where rod pendants are not used, channel supports are to be secured to structure at each end.
- E. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt “wings” are not acceptable.
- F. Support single conduit runs using a properly sized galvanized conduit hanger.
- G. Group related conduit on conduit rack. Construct rack using steel channel; provide space on each rack for 25 percent additional conduits.
- H. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.
- I. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks. Coordinate routing with Architect / Owner.
- J. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners.
- K. Galvanized Surfaces: Clean welds, bolted connections, cuts, and abraded areas and apply ZRC galvanized paint or equivalent.
- L. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.
- M. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers.
- N. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- O. Anchors:
 - 1. Rawl Plugs or approved equal anchors.
 - 2. Lead cinch anchors or pressed anchors.
- P. Hardware:
 - 1. Indoors: cadmium plated unless noted otherwise
 - 2. Exterior: Galvanized unless noted otherwise
- Q. Prohibited Installation.
 - 1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 2. Do not support conduit from conduit, ceiling support wires, roof deck, structural bridging
 - 3. Plastic anchors and lead anchors shall not be used for overhead applications.
 - 4. Beam clamp attachments to steel joist chords
 - 5. Do not support more than one conduit from a single all-thread rod support.
 - 6. Do not utilize Tie wire or short pieces of conduit as supports or hangers.
- R. Acceptable Manufacturer’s
 - 1. Kindorf,

2. Unistrut,
3. Superstrut,
4. Caddy,
5. Minerallac

3.10 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, grade level other than floor, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
 1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
 2. Sleeves shall extend 3-inches above the finished floor.
- B. Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.
- C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.
- D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to serve as a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.
- E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with 1/4-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.
- F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.
- G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.11 PVC CONDUIT AND FITTINGS INSTALLATION

- A. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.

3.12 FLEXIBLE METAL AND LIQUID TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS INSTALLATION

- A. Liquid Tight Flexible Metal Conduit shall only be used for connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
- B. Liquid tight flexible metal conduit may be 0.5-inch for roof top supply / exhaust fans only
- C. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc.
- D. Prohibited Installation:
Do not use for exterior wall or roof penetrations unless sleeved utilizing PVC coated RGC conduit at least one size larger than the outside diameter of the flexible conduit.

3.13 EXTERIOR IN-GRADE PULL BOXES

- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.14 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / communication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION 26.05.33

SECTION 26.05.35
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Electrical connections as required and scheduled, and as specified.

1.02 RELATED WORK

- A. Refer to other Divisions for specific individual equipment electrical requirements.

1.03 QUALITY ASSURANCE

- A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.
- B. Raceways: Refer to related sections.
- C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.
- D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.
- B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.
- C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.

- D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.
- E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.
- F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable conduit, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.
- G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:
 - 1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
 - 2. Where conduit originates from an elevation above the conduit entry, provide a "T" conduit below the enclosure's bottom elevation. Provide conduit from the conduit up to the enclosure bottom horizontal surface for electrical connection.
- H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.
- I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.
- J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION 26.05.35

SECTION 26.05.37
ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.02 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS

2.01 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
 - 1. Type of Various Locations:
 - a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
 - b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
 - c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
 - d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
 - e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
 - f. Surface: Type FS or FD box with surface cover.
 - g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
 - h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
 - i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
 - 2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories

shall be compatible with outlet boxes used and meet requirements of individual wiring.

- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.
- C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.
- D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
 - 1. Type for Various Locations:
 - a. Minimum Size: 4-inch square, 2-1/8-inches deep.
 - b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
 - c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners
- E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.
- F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
- G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.01 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.
- B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.
- C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch

deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.

- D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.
- E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.
- F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.
- G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
- H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
- I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
- J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- K. Provide knockout closures to cap unused knockout holes in boxes.
- L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
- M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.

- N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
- O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
- P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
- Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.
- R. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example "MSB to Panel HA"). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example "LA2" referring to Panel LA sec. 2 is to be listed as "LA"). Label covers for special applications explaining contents (example "Emerg. Gen. Annunciator controls", "IDF ground"). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example "Not Used Panel LA". Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
- S. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- T. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- U. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- V. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
- W. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- X. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Y. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- Z. Use adjustable steel channel fasteners for hung ceiling outlet box.
- AA. Do not fasten boxes to ceiling support wires.

- BB. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
- CC. Use gang box where more than one device is mounted together. Do not use sectional box.
- DD. Use gang box with plaster ring for single device outlets.
- EE. Support outlets flush with suspended ceilings to the building structure.
- FF. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- GG. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
 - 1. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.
- HH. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
- II. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
- JJ. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
- KK. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- LL. Bond equipment grounding conductor to all junction and pull boxes.
- MM. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
- NN. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
- OO. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.02 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION 26.05.37

SECTION 26.05.38
ELECTRICAL FLOOR BOXES AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide electrical floor box and fitting work as required, scheduled, indicated, and specified.

1.02 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL labeled.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Thomas & Betts, Memphis, TN
- B. Hubbell
- C. Wiremold

2.02 CONCEALED SERVICE - FLOOR BOXES

- A. Series 665/667 as manufactured by Thomas & Betts
- B. Shall be electro-galvanized, 14 gauge sheet steel except at ground floors or waterproof membrane floors where they shall be cast iron.
- C. Construction shall be as required by UL 514A.
- D. Carpet frame shall be nylon UL Recognized Component QMFZ2.
- E. Hinged outer cover shall be reinforced with a 5/32" steel plate.
- F. Shall deliver electric power from duplex receptacles installed below the surface of the floor.
- G. Shall deliver telephone or data cable without interference from the electric power delivery
- H. Shall protect delivery of both services by a hinged cover with a retractable opening and foam plastic dust seal
- I. Hinged cover shall accept carpet or tile to match floor covering and be 180 degrees reversible.
- J. Shall accept conduit sizes up to 1-1/4 inches
- K. Box shall be listed by UL

- L. When hinged cover is closed and no services in place, device shall have no obstructions above surface of floor.

2.03 CONCEALED SERVICE, FIRE RATED, POKE-THROUGH SERVICE FITTINGS

- A. Wiremold Evolution Series - 6AT / 8AT
- B. Shall be UL classified for use in up to four hour rated concrete floors, and up to three hour rated steel and concrete floors.
- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign material with a neoprene gasket at base of fitting.
- D. Shall be installed in a single core drilled hole
- E. Shall permit use with "H" cut opening in carpet so carpet can be restored if position is vacated
- F. Shall have interchangeable service fitting accessories including hinged guard and low voltage communication inserts
- G. Service fitting head shall be bronze.
- H. Low voltage channel shall accept one 50 pair, 24 AWG cable through communication raceway.

2.04 SERVICE FITTING HEADS

- A. Shall be brushed aluminum
- B. Shall deliver electrical power from receptacles as designated on the plans
- C. Shall deliver telephone/data through precut bushed opening
- D. Shall be furnished standard with required receptacles
- E. Shall be furnished standard with conduit nipple for direct screw threading into T&B cover assembly
- F. Shall be listed by UL

2.05 FURNITURE FEED POKE-THROUGH DEVICES

- A. Wiremold 4FFATCAL
- B. Shall be UL classified for use in up to four hour rated concrete floors, and up to three hour rated steel and concrete floors.
- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign material with a neoprene gasket at base of fitting.

- D. Shall be installed in a single core drilled hole
- E. Aluminum finish.

2.06 FLOOR BOXES

- A. Thomas & Betts 640 / 840 Series
- B. Floor boxes used on ground floors or in floors with waterproof membranes shall be cast iron, painted inside and out with weatherproof paint intended for use on metal as indicated on the plans.
- C. Floor boxes used in floors without waterproof membranes shall be formed steel with zinc or cadmium plate at least .0005" thick on the outside and .00015" thick on the inside as indicated on the plans.
- D. Construction shall be as required by UL 514A.
- E. Carpet or tile frame shall be brass.
- F. Cover assembly shall protect against the ingress of water or foreign material with a gasket and shall be UL listed as mop tight.
- G. Shall deliver electric power from receptacles installed at the surface of the floor or from service fittings.
- H. Telephone/data cable without interference from electric power delivery.
- I. Cubic inch capacity shall be as required.
- J. Boxes shall accept conduit sizes as required.
- K. Shall be listed by UL

PART 3 - EXECUTION

3.01 GENERAL

- A. Locate position for floor boxes and runs of conduit as shown on the plans, or as required. Coordinate with the Architect for dimensional locations of floor boxes prior to cutting or pouring slab.
- B. Select appropriate size of floor boxes, poke-through, or multiple services floor boxes for quantity of wiring devices indicated and as recommended by manufacturer.

3.02 INSTALLATION

- A. Position floor boxes and conduit runs

- B. After concrete pour, pull wires and install devices according to manufacturer's recommendations.
- C. Activate in accordance with the National Electrical Code.
- D. Coordinate with floor covering contractor to complete installation.
- E. Core drill openings for poke-through service fitting and install in accordance with manufacturer's instructions.
 - 1. Minimum spacing of 2' on center and not more than one unit per each 65 square feet of floor area in each span; required by Fire Resistance Directory.

END OF SECTION 26.05.38

SECTION 26.12.15
DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work Included: Low Voltage (less than 600 Volt) transformer work as shown, scheduled, indicated, and specified.
- B. Types: Transformers required for the project include dry-type transformers.

1.02 QUALITY ASSURANCE

- A. Standards: Transformers shall be designed and tested in accordance with NEMA and ANSI C33.4 and C89.2 standards.
- B. UL Label: Transformers shall be UL labeled.

1.03 STANDARDS

- A. UL-506
- B. ANSI C75.11
- C. NEMA ST-20
- D. DOE 2016 Efficiencies

1.04 SUBMITTALS

- A. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, sound level, tap configurations, insulation system type and rated temperature rise.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric
- C. Siemens
- D. Eaton
- E. Acme

F. Hammond

2.02 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide transformer manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended, and as required for a complete installation.

2.03 DRY-TYPE TRANSFORMERS

- A. General: Indoor transformers shall be dry-type, multiple-winding transformers, rated as shown, and shall have manufacturer's standard impedance.
- B. Construction: Transformer core shall be constructed of cold-rolled, oriented, high permeability silicon steel, either formed as a coil or laminated.
- C. Taps: Transformers 15 to 30 kva shall have two 5% taps, one above and one below normal. Transformers 45 kva and larger shall have four 2-1/2% taps, two above and two below normal.
- D. Temperature Rating: Transformers shall use an insulation system that has been temperature classified and approved by UL. Transformers shall have a maximum winding temperature rise of 150°C with an insulation system temperature classification of 220°C.
- E. Load Rating:
- Transformers shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40°C.
 - Transformers shall be capable of meeting the daily overload requirement of ANSI C57.12.
- F. Vibration Isolation: Each transformer core and coil shall be mounted in the transformer enclosure on rubber vibration isolators.
- G. Sound Rating: The transformer shall have sound levels equal to or lower than those ratings established in NEMA ST-20 and as shown in the following table. Sound ratings shall be measured in accordance with ANSI C89.91.

Transformer Rating (kva) (600 Volt Class)	Maximum Sound Level Decibels: NEMA ST- 20
0 to 9	40
10 to 50	45
51 to 150	50
151 to 300	55
301 to 500	60

- H. Testing:
- The manufacturer shall have tested each transformer for proper operation before shipment.

2. The manufacturer shall have performed the following additional tests on units identical to the design type being supplied. Furnish proof of performance of these tests in the form of test data sheets upon request:
 - a. Sound levels.
 - b. Temperature rise tests.
 - c. Full-load core and winding losses.
 - d. Percent regulation with 80 and 100% power factor load.
 - e. Percent impedance.
 - f. Exciting current.
 - g. Insulation resistance.

PART 3 - EXECUTION

3.01 INSTALLATION OF TRANSFORMERS

- A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.
- B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Only where specifically indicated on the plans or approved in writing by the Owner/Engineer, transformers shall be trapeze mounted using properly sized Amber/Booth type BRD rubber-in-shear hangers. Transformer enclosures shall make no contact with wall surfaces.
- C. Conduit: Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.
- D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.

3.02 TESTING

- A. Insulation Tests: Before energizing, check transformer windings for continuity.
- B. Winding Current: During initial no-load energizing, check current in each primary winding.
- C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings.
- D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and

time of tests, relative humidity, temperature, and weather conditions.

- E. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION 26.12.15

SECTION 26.24.16
PANELBOARDS AND ENCLOSURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.02 QUALITY ASSURANCE

- A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric Co.
- C. Siemens
- D. Eaton

2.02 MATERIALS AND COMPONENTS

- A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.
- B. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.

- D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
 2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
 3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 4. Provide permanent lock-off device where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
 5. General requirements:
 - a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
 - b. Two and three pole breakers shall have internal common trips.
 - c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
 - d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
 - e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
 - f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
 - g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
 - h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).
- E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.
- F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.
- G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit

current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.

H. Panelboard Enclosures:

1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner's standard key system; coordinate with Owner.
2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not use third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
7. Enclosure shall be for recessed or surface mounting as shown or as required.
8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.01 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.
- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room

number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

- E. Fuses: Install fuses, of the ratings and class shown.
- F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.
- G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.
- H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as “not used” and include panel identification.
 - 1. Provide (3) 1-inch and (3) $\frac{3}{4}$ -inch spare conduits above accessible ceiling to j-box from each panelboard section.
 - 2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) $\frac{3}{4}$ -inch conduits to j-box in ceiling space on floor below.
- I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.
- J. Circuit breakers and conductors installed for SPD devices shall be located at the top or bottom of the panelboard in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.
- K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.
- L. Install panels so that breaker number 1 is the top left breaker.
- M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.
- N. Label breaker mounting space with stick-on number labels.

- O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.
- P. Perform the following actions during the installation of panelboards and similar equipment on 4-wire, delta-connected systems where the midpoint of one phase winding is grounded (240V, 3Ø, high-leg delta systems):
 - 1. Identify the high-leg provided by the serving power company. It shall not be assumed that the high-leg is the same as identified on electrical documents until proper voltage testing and power company coordination has been performed.
 - 2. In existing installations, it shall be permitted for the high-leg to be any phase other than "B" phase. New panelboards installed in these systems shall have their high-leg phase matched to existing panelboards and equipment. All new building electrical system installations shall be performed with the high-leg on the "B" phase of each electrical panelboard.
 - 3. Each panelboard which contains a 4-wire, delta-connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked with an orange placard with the following: "Caution ___ Phase Has ___ Volts to Ground. There shall be no phase-to-neutral connections made between this Phase ___ and Neutral within this panelboard."
 - 4. Mark the high-leg phase busbar and conductor durably and permanently with an outer finish that is orange in color.

3.02 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.

END OF SECTION 26.24.16

SECTION 26.24.25
ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.
- B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric Co.
- C. Siemens
- D. Eaton

2.02 ENCLOSED SWITCHES

- A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horse power served.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Switch Mechanism:
 - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the

- switch mechanism when the switch door is open.
2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

- D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.

2.03 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

- A. Overcurrent protective devices 1,200 Amps and below:
 1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
 2. Molded case circuit breakers:
 - a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 - b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
 - c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 3. Fusible switches:
 - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
 - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - c. 600 Amps and below equipped for Class J fuses.
 - d. 601 Amps and above shall be equipped for Class R or L fuses.
 - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building

operation.

2. The ground fault system shall be factory-tested before shipment as specified:
 - a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
 - b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
 - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.04 ENCLOSURES

- A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
- B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
- C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.
- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.

- D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.
- E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.
- F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: "WARNING" (1/2 Inch Letters). "TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE." (1/4 inch letters).
- G. Provide disconnect switch for electric duct heaters.
- H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.

3.02 TESTING

- A. General: Before energizing, check for continuity of circuits and short circuits.

END OF SECTION 26.24.25

SECTION 26.27.73
LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.02 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6.
- C. Fed. Spec. WC596, W-S-896

1.03 SUBMITTALS

- A. Submit a sample of each style and color of 120V, 20A duplex receptacle and each 120/277V switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
- B. Submit manufacturer's product data sheet for each style of device and plate on the project.
- C. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Toggle Switches, Straight Blade Devices, Interior Cover Plates:
 - 1. Leviton, Mfg. Co., Inc.
 - 2. Pass and Seymour, Inc.
 - 3. Hubbell, Inc.
 - 4. Eaton – Arrow Hart
- B. Dimming
 - 1. Leviton
 - 2. Lutron

2.02 WIRING DEVICE COLOR

- A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches.

2.03 RECEPTACLES

- A. Industrial grade tamper resistant duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
 - 1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #M5362-SGX
 - 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #MT562-IGX
 - 3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R: Leviton #T7899-HGX
 - 4. 20A, 125V grounded tamper and weather resistant (WR) receptacles: Leviton #TWR20-GY
- B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back wiring, black molded phenolic compound, NEMA configuration as indicated.
 - 1. 30A, 125V grounded single NEMA #5-30R: Leviton #5371 with #80728X cover plate.
 - 2. 30A, 250V, grounded, 3-wire, 2-pole NEMA #6-30R: Leviton #5372 with #80728X cover plate or weatherproof cover plate.
 - 3. 20A, 125/250V, grounded, 4-wire, 3-pole NEMA #14-20R: Hubbell #8410 with Leviton #84004-40 cover plate.
 - 4. 20A, 125V, grounded, NEMA 5-20R, Leviton #5801W with Leviton #84004-40 cover plate.
- C. USB Charger / Tamper-Resistant Receptacle:
 - 1. 20A, 125V, NEMA 5-20R, 2.1A, 5VDC USB 2-port: Leviton #T5830-GY
- D. USB Charger, 5VDC pigtail power supply / Tamper-Resistant Receptacle:
 - 1. 15A, 125V, NEMA 5-15R; 3.0A, 5VDC USB 1-port with pigtail power supply with on/off switch for AV/USB signal repeaters: Hubbell #AVPS15XX.

2.04 WALL SWITCHES

- A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
 - 1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
 - 2. Double Pole 120/277V, 20A switch: Leviton #1222-2X
 - 3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
 - 4. Four-way, 120/277V, 20A switch: Leviton #1224-2G

- 5. Single-pole, 120/277V, 20A switch, red pilot light: Leviton #1221-PL
- B. Rotary key operated switch.
 - 1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
 - 2. Two-pole, 120/277, 20A key operated, Leviton #1222-2KL.
 - 3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL
 - 4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
 - 5. Key switches shall be all keyed alike to match the Owner's standard key system. Coordinate with Owner.
- C. Local relay switch for remote control low voltage switching systems: Hubbell #HBL-1556 GY, single pole double throw, center off, momentary switch, 277V, 15A; Hubbell #HBL 1556L for key lock type.
- D. Leviton #5657-2, single pole double throw, center off, momentary contact, 277V, 20A

2.05 WALL DIMMERS

- A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
 - 1. Single-pole, 120/277V, 1000/2308 watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
 - 2. Single-pole, 120/277V, 1500/3463 watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
 - 3. Single-pole, 120/277V, 1920/4432 watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
 - 4. Three, four or five way remote switch: Leviton #AWSRT-00W.
 - 5. Color change kit as required.

2.06 INTERIOR WALL COVER PLATES

- A. Satin finish Type 302 stainless steel.
 - 1. Type 302 stainless steel screws satin finish.
 - 2. Laser engraved with black letters, Panel Name, Circuit Number and Voltage
 - 3. Wiring devices connected to emergency generator: Laser engraved with black letters "EMERGENCY"

2.07 EXTERIOR COVER PLATES

- A. Thomas & Betts CKSUV, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.

2.08 CORD REELS

- A. Cord Reels:
 - 1. Receptacle only, 20A, Hubbell #HBL45123GF220WM1 with #HBL340PB pivot base.

2. Hand Lamp only; Hubbell #HBL50162FL with #HBL340PB pivot base (automotive repair garage location)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All wiring devices for receptacles and wall switches shall be of the same manufacturer throughout unless otherwise noted.
 1. Only Lutron dimming controls shall be used with Lutron dimming electronic ballast and LED drivers.
 2. Key switches shall be as specified and as approved by Owner.
 3. Submit color sample for each specified color to Architect.
- B. Install wiring devices where shown, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from excess building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, or ceiling in where they are installed.
- E. Install switches in boxes on the strike side of doors as hung. Install a uniform position so the same direction will open and close the circuit throughout the project. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a plate for every receptacle, switch, unused rough-in only outlet and other wiring devices. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.
- G. Mounting heights of all wiring devices shall comply with current Accessibility Standards and local codes, except where wiring devices are indicated for special purpose and access. Is only required by maintenance or service personnel.
- H. Provide tamper resistant receptacles protected upstream by switch rated GFCI blank face feed through device in all child day care, pre-kindergarten and similar areas designated for occupancy by pre-K, or child day care occupants. Locate blank face GFCI near light switches at same height as light switches.
- I. Provide tamper resistant receptacles in all kindergarten through fifth grade areas designated for occupancy by kindergarten through fifth grade.
- J. Refer to Architectural drawing, elevations, etc. for exact location of wiring devices where indicated on the Architectural plans. Coordinate location of all wiring devices with other specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts during construction.

- K. Provide GFCI receptacle for drinking fountains. Locate receptacles for electric drinking fountains below drinking fountain so that the receptacle is accessible and concealed as much as practical from public view by the drinking fountain cowling. Locate under upper drinking fountain at dual level fountains.
- L. Provide weatherproof and weather resistant (WR) NEMA 3R, GFCI, 20A, 125V duplex receptacles outdoors where indicated and within 25-feet of all new electrically operated mechanical equipment mounted outdoors and on roofs.
- M. Install wall box dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- N. Do not share neutral conductor on dimming circuits.
- O. Install receptacles with grounding pole down, or as directed by Owner. If installed horizontally, install with neutral on top.
- P. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- Q. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.
- R. Provide nameplate engraving for all line voltage switches and receptacle outlets indicating panelboard and circuit number.
- S. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.
- T. Provide disconnect toggle switch within sight of all trap primers, circulation pumps, 120 volt motors and motorized equipment.
- U. In public areas provide engraved blank face GFCI switch cover plate for GFCI devices with black lettering explaining function as follows. "EDF Recept" for drinking fountains, "Rm Recepts" for Pre-K and Day Care, "Frig Recept" for refrigerators. For other loads, Owner shall determine wording. If in question, public areas are as determined per Owner.
- V. Provide engraved switch cover plates with black lettering explaining function for switches that operate loads other than room lighting. Wording shall be per Owner.
- W. Mount cord reels to structure as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.

3.02 TESTING

- A. Before energizing, check for continuity of circuits, short circuits, and grounding connections. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization. Test GFCI receptacle operation with simulated ground fault tester.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

END OF SECTION 26.27.73

SECTION 26.32.14
DIESEL STANDBY GENERATOR SETS and TRANSFER SWITCH

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.02 WORK INCLUDED

- A. Furnish and install standby engine-driven generator system, complete with wiring and controls as shown on the drawings and as specified herein.
- B. The standby emergency system shall consist of an engine-driven generator set, complete for outdoor installation, automatic transfer switches and associated fuel system.

1.03 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Engine-Driven Generator Sets:
 - a. Onan/Cummins/Southern Plains Power.
 - b. Rehlko/Kohler
 - c. Caterpillar
 - d. WPI Generac Industrial Power
 - 2. Automatic Transfer Switch.
 - a. Onan
 - b. Kohler
 - c. Russelectric
 - d. ASCO
 - e. Zenith
 - f. Eaton
 - g. Standby electric generating system manufacturer (as an integral part of a complete system).
- B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110), and with NFPA 37 Installation and Use of Stationary Combustion Engines and Gas Turbines.
- C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.
- D. EPA Compliance: Comply with all EPA Standards for permanently installed emergency generator.
- E. The generator set shall receive the manufacturer's standard factory load testing.
- F. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade Power System products for a minimum of 15 years. The supplier shall provide initial

start-up services, conduct field acceptance testing, and warranty service. The supplier be authorized to perform warranty service on all products provided. Within 50 mile of the job site, the supplier shall maintain; a minimum of 6 factory trained and qualified field technicians; a proper supply of spare parts for the supplied equipment; a shop with overhaul capabilities; and be able to provide 24 hour, 7 day per week, 365 day per year field service capability.

1.04 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit manufacturer's Installation, Start-Up and Service instructions.
 - 1. Recommended conductors, overcurrent protection and disconnect size.
 - 2. Electrical interlocks.
- C. Submit recommended clearance dimensions.
- D. Submit internal wiring diagram of Control Center.
- E. Submit sequence of operation in narrative form.

PART 2 - PRODUCTS

2.01 ENGINE-GENERATOR SETS

- A. The engine-generator set shall be furnished as a complete working system. The model provided shall be a standard model that is quality assurance tested and prototype tested, not one of a kind without supporting literature.
- B. Engine shall be manufactured in the United States, liquid cooled, reciprocating engine, 24V DC electric start, diesel fueled, electronic isochronous governed with manual speed adjustment plus/minus 5%, with belt-driven battery charging alternator. Regular scheduled maintenance items such as fuel filters, oil filters, belts, hoses, etc. shall be readily available from multiple sources within 50 miles of the project site.
- C. The set shall provide the following performance:
 - 1. Rated power for the duration of any utility power outage, in ambient conditions to 50-feet altitude and an outside air ambient temperature of 10 degrees F to 110 degrees F. Liquid coolant system ratings for diesel sets through 140 Kw shall be rated at 122 degrees F ambient.
 - 2. Start and accept rated load within 10 seconds of utility power outage.
 - 3. Voltage regulation of plus/minus 2% no load to full load, with random voltage variation, at any constant load, less than plus/minus 1%.
 - 4. Isochronous frequency regulation, less than plus/minus 0.5% at any steady state load from no load to full load.
 - 5. Comply with all Federal emissions regulations.
- D. Engine Coupling: Engine shall be directly connected to the generator through a suitable flexible coupling.
- E. Generator:

1. The generator shall be a standard make, 4-pole, revolving field, single bearing, and synchronous, brushless type with the following characteristics:
 - a. Capacity as shown on the drawings and shall operate at 1800 rpm.
 - b. Dripproof, self-ventilating, permanently aligned and complete with rotating brushless exciter and shall be of ball bearing construction and connected to the engine with flexible disc coupling.
 - c. Conform to the latest applicable IEEE and NEMA standards.
 - d. Provided with generator overload protection.
 - e. Output main circuit breaker(s) with adjustable LSI trip for cable protection shall be provided when shown on drawings.
 - f. Voltage Regulator: Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from miss-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field.
 - g. Alternator: The generator shall be capable of withstanding a three phase load of 300% rated current for 10 seconds, and sustaining 150% of continuous load current for 2 minutes with field set for normal rated load excitation.
 2. Provide the generator with the following:
 - a. NEMA Class F or H insulation as defined by NEMA MG1.65.
 - b. Pre-lubricated, maintenance free ball bearing, lubricated for life.
 - c. Direct drive centrifugal blower cooling.
 - d. RFI filters on the exciter to eliminate radio frequency interference on electronic equipment.
 - e. Thermostatically controlled block strip heater mounted for condensation control.
- F. Fuel System Sub-Base: The engine power plant shall be mounted on an I-beam, dual wall sub-base tank (72 hour fuel capacity at full load or day tank with remote bulk storage) of fabricated aluminized steel construction. The assembly shall be installed on a vibration-absorbing base on a concrete pad as shown on the drawings. The tank assembly shall have low fuel alarm, rupture basin alarm, fuel solenoid valve and tank controller and pump for use with an overhead main fuel supply.
- G. Automatic Starting Sequence of Events:
1. Upon drop in normal source voltage to 65 to 70% of rated voltage, or upon failure of the normal source of electrical supply, the engine shall be automatically cranked and brought up to the full operating speed.
 2. The cranking motor circuit shall be instantly broken when the engine starts.
 3. Within 10 seconds the generator shall be brought up to operating speed; the generator voltage shall operate the automatic transfer switch, disconnecting the load from the normal source of supply and connecting the emergency power to the load.

4. Upon restoration of the normal source voltage to 92 to 95% of rated voltage or restoration of normal source of supply, the sequence shall be reversed, restoring the transfer switch to the automatic normal operating position, disconnecting the load from the emergency generator and reconnecting the load to the normal source of supply. The emergency generator set will continue to operate for a period of from 1 to 5 minutes after the restoration of the normal source of supply. Should the engine fail to start upon the first crank, there shall be two additional cranking attempts made with a 15 second rest between cranks, after which the cranking cycle shall cease and an alarm shall sound to indicate malfunctioning of the system.
5. The controls shall automatically stop the engine in the event the cooling water temperature becomes too high, if the coolant level becomes too low, if the oil pressure drops below a pre-determined pressure, or if the engine overspeeds. Upon the failure of the engine for any of the above reasons, an indicating lamp will operate indicating the condition under which the engine was shut down. Also, the alarm signal shall be energized.

H. Engine Control Panel & Accessories:

1. Provide a comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 seconds. Acceptable methods are a fully rated (100%) 600 volt Circuit Breaker, mounted in the generator enclosure, Square D Programmable Trip of size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based GenSet AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cool down at idle function. While operating in idle state, the control system shall disable the alternator excitation system. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The Control Panel shall include, but is not be limited to, the following instruments and protective devices:
 - a. AC Ammeter.
 - b. Phase Selector Switch.
 - c. Current Transformers.
 - d. AC Voltmeter.
 - e. Automatic Solid State Voltage Regulator with immunity to severe induced waveshape distortion from nonlinear loads.
 - f. Rheostat for adjusting voltage $\pm 5\%$ of Rated Voltage.
 - g. Fuel gauge.

- h. Engine Malfunction Warning Lights/Audible Alarm:
 - 1) Anticipating High Engine Temperature.
 - 2) Anticipatory Low Oil Pressure.
 - 3) Low Fuel.
 - 4) Control Switch not in Automatic Position.
 - 5) Low Water Temperature.
 - 6) Low Oil Pressure.
 - 7) High Water Temperature.
 - 8) Engine Overcrank.
 - 9) Engine Overspeed.
 - 10) Day Tank Leak Detection.
 - 11) Bulk Tank leak detection
 - 12) Bulk Tank high fuel
 - 13) Bulk Tank low fuel
 - i. Frequency Meter.
 - 1. Non-resettable Elapsed Time Meter with a 99,999.9 Hour Maximum Indication.
 - 2. Coolant Temperature Gauge.
 - 3. Oil Pressure Gauge.
 - 4. Provisions for Remote Emergency Shutdown.
 - 5. Combination alarm shutdown system with manual reset and indicating lights for high engine temperature, low oil pressure, engine overspeed, and engine failed to start. Include an additional set of contacts for remote alarms.
 - 6. Manual run/off/automatic selector switch for control of engine with flashing red light, and shall allow manual starting of plant without assuming load.
 - 2. Provide low coolant level shutdown, which shall activate high engine temperature lamp and shutdown.
 - 3. Solid-state cranking cycle device preset at 15 second cranking cycle and 15 second rest cycle followed by a 15 second cranking cycle. If engine fails to start after 3 crank cycles and 2 rest cycles, an overcranking alarm shall sound and cranking cycle shall stop. Provide adjustments in accordance with manufacturers recommendations, but cumulative crank-rest timing shall not be less than 75 seconds.
 - 4. In the event of engine failure, the panel shall close alarm circuit, indicate the fault on the appropriate lamp and shut down the engine. The panel shall include a manual reset switch so that the panel can be reset immediately after a fault condition. Reset devices that require a waiting period are not acceptable.
- I. Options and accessories shall include the following:
- 1. Housing: The complete engine generator set shall be enclosed in a free-standing weather protective, aluminum (0.063-inch) panel construction housing with lockable, removable hinged door panels, hinged instrument panel door and panel light. Housing shall be wind rated to 150 mph.
 - a. All parts shall be adequately protected against oxidation and corrosion and finish painted with durable machinery enamel, minimum of 3 mils applied in a maximum of 1-1/2 mils per application.
 - b. Include within the enclosure a switched LED vapor-tight luminary on each side of the engine and a GFCI receptacle.
 - c. The enclosure must maintain the engine and generator at 32°F or be equipped with space heaters to maintain starting batteries between 50°F

- and 90°F.
2. 24V battery starting with maintenance free lead acid batteries with dual rate solid state automatic battery charger, with equalize timer, low and high battery voltage indicators and alarm terminals, charger malfunction indicator and alarm. Batteries shall be capable of providing two 45 second continuous cranking cycles. Provide battery racks, and charger shall be protected from any other charging source.
 3. Muffler, critical silencing, with condensation drain; stainless steel flexible exhaust connector. Silencer shall mount horizontally on structural support (of housing) with 90 degree elbow termination with rain cap.
 4. Water jacket heater, 120 VAC, 1 phase, 1500 watts minimum.
 5. Unit mounted emergency shut-off mushroom type pushbutton switch.
- J. Testing: The unit shall be given a complete shop test before shipment. It shall be installed on the job under supervision of the manufacturer's representative, and shall receive start-up/commissioning service from that representative.
1. The unit shall be started cold and run for a one-hour test with building load connected.
 2. Retransfer the load after test.
 3. After this test, the set shall cool for five minutes, then must start and carry full building load for four hours.
 4. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit.
- K. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided as specified.
1. Operating Instructions: Provide and install in a suitable enclosure operating instructions for the engine generator set.
 2. Contractor shall fill the radiator with a combination of water and ethylene-glycol to protect the radiator to -20°F after completion of the test.
- L. Programming: Program the exerciser to operate for 30-minutes every Tuesday morning at 8:00 a.m. with no-load. Program the test button to transfer with load.

2.02 DIESEL FUEL DAY TANK WITH SUPPLY PUMP AND MOTOR

- A. Day tank shall be Engine & Compressor Accessories DT Series or approved equal, and constructed in accordance with Underwriter's Laboratories Standard UL-142. The day tank shall also be constructed in accordance with Flammable and Combustible Liquids code, NFPA 30; and the Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, NFPA 37. Day tank shall be made of heavy gauge steel lap joint construction. Tank shall include removable, welded steel top cover for indoor applications, and welded steel, weatherproof cover for outdoor applications. Tan interior shall be coated with a permanent, rust inhibiting, two part epoxy. Interior temporarily coated with solvent-based or petroleum based film rust preventative shall be unacceptable. Tank shall be primed and finish painted outside. The tank shall include the following fittings:
1. 1 inch NPT engine supply
 2. 1 inch NPT engine return

3. NPT fitting for emergency vent, sized as appropriate
 4. 1 inch NPT overflow
 5. 1 inch NPT alternate fuel return
 6. 1-1/4 inch NPT normal vent
 7. 5 inch square inspection port below electrical controls
- B. The tank shall be provided with atmospheric (normal) vent cap with screen and appropriately sized UL Listed emergency vent cap. UL Listed emergency vent cap shall be pressure operated. Opening pressure shall be 0.5 psig; full opening pressure 2.5 psig. Limits shall be marked on top of each vent.
- C. The tank shall include a welded steel containment basin to prevent fuel spilling into the environment in the event of a tank leakage. The basin shall be primed and finish painted.
1. Secondary Containment: The secondary containment shall consist of a welded heavy gauge steel structure. The secondary containment shall be provided with atmospheric (normal) vent cap with screen and appropriately sized UL Listed emergency vent cap.
- D. A secondary tank leak detector flat switch shall be wired into the control circuitry. This will shut down the supply pump and motor, and de-energize the solenoid in case of a fuel leak into the containment basin.
- E. The tank shall include a direct-reading fuel level gauge.
- F. The control circuitry shall be designed and supplied as an engineered system by Engine & Compressor Accessories. The controller shall have replaceable relays. The controller shall have independent float switches to provide multiple signals to the control circuitry.
1. Control Functions
 - a. "Press-to-Test" fill control momentary switch
 - b. Critical high fuel level (pump/motor shutdown)
 - c. High fuel level
 - d. Low fuel level
 - e. Critical low level
 - f. Rupture basin alarm (pump/motor shutdown)
 - g. Pump/motor and solenoid control
 2. Indication Functions
 - a. Pump running
 - b. Critical high fuel level
 - c. High fuel level
 - d. Low fuel level
 - e. Critical low level
 3. Outputs (one set of normally open and normally closed 10 amp @ 120 VAC relay contacts for remote annunciation):
 - a. Critical high fuel level (pump/motor shutdown)
 - b. High fuel level
 - c. Low fuel level
 - d. Critical low level
 - e. Rupture basin alarm (pump/motor shutdown)

- G. The tank shall include a positive displacement bronze rotary gear fuel oil pump to draw fuel oil from the main tank to the day tank. Pump capacity shall be sized as appropriate and provide a minimum of 15 feet of vertical lift of diesel at sea level. A motor shall be provided of sufficient horsepower to operate the pump.
- H. In applications requiring a duplex pumping system, the tank shall include two bronze rotary gear pumps and two motors.
1. Non-Alternating System
 - a. The lead pump shall activate when the fuel level declines to 85% of tank capacity; the second pump shall activate and operate in tandem with the lead pump if the fuel level declines to 82% of capacity.
 - b. Check valves shall be provided on the pump fuel inlets.
 - c. Run-Off-Auto switches replace standard Press-to-Test switch
- I. A reverse pumping system shall be provided in applications where the primary tank's maximum fuel level is at a higher level than the day tank. The reverse pump/motor will return fuel to the primary tank in the event the day tank level exceeds its normal capacity. The reverse pump shall be activated by a separate float switch. The reverse pump capacity will be equal to or greater than the capacity of the supply pump. If the tank includes a duplex supply pumping system, the reverse pump shall be equal to or greater than the combined capacity of the two supply pumps.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Rating and Construction:
1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosures and accessories. All transfer switches shall have switched neutrals and shall be electrically operated and mechanically held.
 2. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings, shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 260	30,000
300 to 1000	65,000
1200	85,000
1600 and larger	100,000
 3. Provide one of the following standard products:
 - a. Onan OTEC or OTPC Series as required
 - b. Kohler K Code Series
 - c. ASCO 940 Series
 - d. Russelectric RMT/RMTD Series
 - e. Zenith ZTSD Series
 4. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical

locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.

5. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
6. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
7. All switches for solid neutral systems (shown as 3-pole on the Drawings) shall have full rated insulated neutral plates. All switches for systems with switched neutrals (shown as 4 pole on the Drawings) shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer/retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.

B. Controls and Accessories:

1. Controls shall provide for the automatic starting sequence of the generator set.
2. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.
3. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid state time delay on transfer, adjustable from 0 to 120 seconds.
4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 60 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
5. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick disconnect for ease of service.
6. Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.
7. For transfer switches serving non-disconnected motor loads, equip with a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The delay feature shall have an adjustable range covering 0 to 7.5 seconds. Transfer switches serving life safety equipment shall have this time delay set at 0 at startup/commissioning.
8. Controls shall signal the engine-generator set to stop after a time delay,

- adjustable from 0 to 10 minutes, beginning on return to the normal source.
9. Power for transfer operation shall be from the source to which the load is being transferred.
 10. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time.
 11. The control shall include provisions for remote transfer inhibit and area protection.
 12. Provide front panel devices mounted on cabinet front consisting of:
 - a. A key operated selector switch to provide the following positions and functions:
 - 1) Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer. Program for load transfer.
 - 2) Normal - Normal operating position.
 - 3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
 13. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
 14. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.
 15. Where elevator loads or load disconnect of motor controls are shown on the plans, provide in switches serving elevators or motors the following:
 - a. Signal module to delay the transfer and retransfer of the switch for up to 50 seconds to provide a pre-transfer warning or load disconnect signal contact. Provide signals for the following conditions:
 - source 1 available
 - source 2 available
 - test/exercise
 - backup source availableContacts for these functions are to be Form C type, rated for 120 VAC or 30 VDC at 4 amps.
 16. When shown on the plans, provide a load shed relay, to move the transfer switch from the emergency position to a neutral position, on receipt of a signal from a remote device.
 17. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The control panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The control panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The control panel shall allow starting and stopping of the generator set via the transfer switch control panel in both test and emergency modes.
 18. Submittals:
 - a. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. All submittals shall be reviewed by the Engineer and approved prior to fabrication.
 19. Instruction Data and Drawings:
 - a. Commercial type operating instructions shall be provided consisting of

operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams.

- b. Operating Instructions: Provide and install in a Plexiglas enclosure complete operating instructions for each type of transfer switch.

2.04 REMOTE ANNUNCIATION PANEL

- A. Provide a remote annunciator panel located next to the ATS. Flush mount with stainless steel plate containing the following:
1. Trouble sonnet horn with silence switch.
 2. Illuminated annunciators with nameplates in accordance with the following table:

Lamp Legend	Generator Set Condition Indicated	Light	Audible Alarm
High Battery Voltage	Battery charger too high	Red	No
Low Battery Voltage	Battery voltage too low	Red	No
Normal Battery Voltage	Battery voltage ok	Green	No
Generator Running	Generator has output voltage	Green	No
Normal Utility Power	Utility power supplying the load	Green	No
EPS Supplying Load	Genset supplying the load	Green	No
Pre-Low Oil Pressure	Oil pressure approaching low limit	Yellow	Yes
Low Oil Pressure	Engine has shut down due to low oil pressure	Red	Yes
Pre-High Coolant Temp.	Temperature of coolant approaching high limit	Yellow	Yes
High Coolant Temp.	Genset has shut down due to high coolant temp.	Red	Yes
Low Engine Temp.	Engine heater has malfunctioned	Red	Yes
Overspeed	Engine has shut down due to overspeed	Red	Yes
Overcrank	Engine failed to start	Red	Yes
Not In Auto	Engine control switch not in AUTO position	Flashing Red	Yes
Battery Charger Malfunction	Charger is signaling a failure	Red	Yes
Day Tank Low Fuel	Day Tank Fuel level below preset minimum	Red	Yes
Fault	Customer pre-selected condition	Red	Yes
Day Tank Fuel Tank Rupture	Fuel Tank Rupture	Red	Yes
Bulk Tank Leak	Bulk Tank Rupture	Red	Yes
Bulk Tank Low	Bulk tank fuel level below preset minimum	Red	Yes
Bulk Tank High	Bulk tank fuel level above pre-set maximum	Red	Yes

- B. Name plates shall be laminated black with white letters engraved. Letter size shall be a minimum of 3/8" high.

- C. Illuminated annunciators shall be 1 inch minimum.
- D. Silence and Lamp Test Switch

2.05 ELECTRICAL AND MECHANICAL PERFORMANCE

- A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.
 - 1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
 - 2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
 - 3. Dielectric: Following the Withstand Current Rating Test, test at 1960 volts AC rms minimum.
 - 4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install standby engine driven generator set where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the set complies with the specified requirements and serve the intended purposes.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.
- C. Vibration Isolation:
 - 1. Generator installed inside building: Install units on properly sized ribbed Neoprene vibration isolators.
- D. Concrete Pad: Install generator set on a reinforced concrete pad. The generator pad shall extend 48-inches beyond the generator set base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the generator pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for concrete work.
- E. Provide #2 diesel fuel for all tests and top off all tanks on the date of substantial completion.
- F. Options and Accessories: Provide circuits, conductors, and raceways as required for generator options and accessories as specified. Provide separate circuits from the emergency lighting and appliance panel board to the generator, heaters, lighting, battery chargers, etc. as required, for a fully operational system.

- G. Provide remote alarm annunciator. Locate in the Administrative Area, or Custodial Area, as directed by Architect / Owner.
- H. Adjust main output circuit breaker(s) adjustable trip setting based on manufacturer's fault current and coordination analysis or as directed by Engineer.

3.02 GROUNDING

- A. Install the generator as a separately derived system. Ground the generator neutral to the generator frame. Ground the generator frame to the building grounding system.

3.03 CONTROLS

- A. Provide generator start-up control wiring and raceway from each automatic transfer switch to the respective standby generator set as required.

3.04 TESTING

- A. Provide testing in accordance with NFPA 110. Upon completion of installation of engine-driven generator set and after building circuitry has been energized with normal power source, test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be a minimum of 4 hours continuous trouble-free operation with at least four automatic transfer switch operations (each switch) within the period of operation. Testing shall be done in the presence of Architect / Owner.
- B. Contractor shall furnish all instruments and personnel required for test. Submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.

3.05 WARRANTY

- A. Provide two-year parts and labor warranty from date of substantial completion. Provide an additional three year parts warranty after the second year, years 3, 4 and 5.

END OF SECTION 26.32.14

SECTION 26.51.13
LIGHTING FIXTURES AND LAMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
 - 1. General lighting
 - 2. Emergency lighting
 - 3. Outdoor area lighting

1.02 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.03 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for approved light fixture manufacturers.
 - 1. Emergency Battery Packs:
 - Bodine
 - IOTA
 - Chloride
 - Lithonia

- Dual Lite
- 2. Emergency Generator/Inverter Load Control Bypass Relay; UL924 listed and 0-10Vdc compatible:
Bodine
Wattstopper
Hubbell
Iota
Nine 24, Inc.
- 3. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
Bodine GTD20A
ETC SC1008

2.02 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, complete with, but not limited to, lamps, lamp holders, reflectors, ballasts, starters, and wiring.
- B. Fixture Types:
 - 1. General:
 - a. Lay-in troffer fixture panel type lenses, where specified, shall be extruded virgin acrylic, prismatic type minimum 0.125" thick, 7.8-ounces per square foot minimum.
 - b. Fixtures in continuous rows shall be supplied with fixture couplings, chase nipples, and accessories recommended by the manufacturer for continuous row installation.
 - c. Safety chains and wire guards at fixtures in mechanical and electrical rooms, gymnasiums and high abuse areas.
 - d. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
 - e. Fixture door frame shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
 - f. DLC or Energy Star qualified unless specified otherwise.
 - g. Minimum 5-year replacement warranty for driver and light engine.
 - h. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
 - i. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - j. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor
 - k. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
 - 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed. Downlight

- fixtures shall have a minimum efficiency of 65-percent and exhibit “lamp before lamp image” 45-degree cutoff for ceiling up to 10 feet.
3. LED Exit Signs: The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
 - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
 4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
 5. All gymnasium light fixtures, acrylic or glass surfaces, shall be vandal proof with wire guards to protect lens and/or refractor.
- C. LED drivers:
1. NEMA 410 compliant for in-rush current.
 2. Drivers shall have a minimum efficiency of 85%.
 3. Starting Temperature: -40° F [-40° C].
 4. Input Voltage: 120 to 480 (±10%) V.
 5. Power Supplies: Class I or II output.
 6. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 7. Power Factor (PF): ≥ 0.90 .
 8. Total Harmonic Distortion (THD): $\leq 20\%$.
 9. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 10. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self testing drivers and inverters; 5 year warranty.
1. Bodine BSL-ST Series for OEM installation
 2. Bodine BSL310-SI Series for field installation
 3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device:
1. 16 Amp minimum ballast / driver load
 2. Compatible with 0-10 Volt dimmer switches
 3. UL 924
 4. Minimum 3-year warranty
 5. Integral or remove test switch.

- I. Emergency Generator / Inverter branch circuit transfer switch:
 - 1. UL 1008
 - 2. 20 Amp ballast/driver load
 - 3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.
- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
- E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.
- F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
- G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
- H. Install in accordance with manufacturers instructions.
- I. Install suspended luminaries using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- J. Locate recessed ceiling luminaries as indicated on the Architectural reflected ceiling plan.
- K. Install surface mounted luminaries plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

- L. Exposed Grid Ceilings: Support surface mounted luminaries on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaries. Fasten surface mounted luminaries to ceiling T using bolts, screws, rivets, or suitable clips.
- M. Install recessed luminaries to permit removal from below.
- N. Install recessed luminaries using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- O. Install wall-mounted luminaries at height as directed by Architect.
- P. Install accessories furnished with each luminary.
- Q. Connect luminaries to branch circuit outlets using flexible conduit as specified.
- R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaries.
- S. Bond products and metal accessories to branch circuit equipment grounding conductor.
- T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.
- U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency transfer devices (GTD). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or GTD circuit shall originate from same branch circuit breaker as switched lighting circuit.
- V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.
- W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.
- X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Where no building management system is provided or specified, provide time clock switches, photocells, photosensors as specified, and required by the local energy codes.
- Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.
- Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.

- AA. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- BB. Hardware for surface mounting fixtures to suspended ceilings:
 - 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - 2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

3.02 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION 26.51.13

SECTION 26.56.00
SITE LIGHTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The extent of site lighting required is indicated on the drawings and schedules and by the requirements of this Section and Section 26 05 00 General Electrical Provisions.
- B. Poles and Standards specified in this Section are for outdoor use for the support of luminaries and include the following: Aluminum and/or steel
- C. Related Sections: Refer to other sections for the following:
 - 1. Lighting Fixtures and Lamps

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Provide luminaries, poles standards and appurtenances conforming to the following:
 - 1. Conform to applicable sections of American Association of State Highway and Transportation Officials (AASHTO): LTS-1 Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.
 - 2. American National Standards Institute (ANSI):
 - a. C2 National Electrical Safety Code.
 - 3. Conform to applicable sections of American Society for Testing and Materials (ASTM)B 429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - 4. National Electrical Manufacturers Association (NEMA):
 - a. FA 1 Outdoor Floodlighting Equipment.
 - b. OD 3 Physical and Electrical Interchangeability of Photo Control Devices and Mating Receptacles.
 - 5. Conform to applicable sections of National Fire Protection Association (NFPA) 70, National Electrical Code.
 - 6. Underwriters Laboratories, Inc. (UL):
 - 7. Design Lights Consortium (DLC)

1.03 SUBMITTALS

- A. Refer to Section 26 05 00 General Electrical Provisions. Submittal must include photometric reports, otherwise they will be rejected as incomplete.
- B. Contractor shall not rough-in, build concrete foundations, etc. for site lighting until all site lighting submittals have been approved. Contractor shall submit site lighting photometrics with product data. The review of site lighting submittals may include the relocation, addition or deletion of lighting fixtures, poles and standards due to the photometric performance of substituted manufacturers. Any changes required due to the contractor's substitution shall be at no cost to the Owner.

- C. Submittal sheets shall be sequentially numbered with the format: Sheet number of number total. Example 1 of 3
- D. Submit manufacturer's product data including the following:
 - 1. Line-by-line compliance of the specification indicating compliance or description of deviation.
 - 2. Submit a computer generated point-by-point calculations for all outside lighting.
 - 3. Dimensioned and detailed drawings in booklet form with separate sheet or sheets for each fixture, assembled in luminarie "type" alphabetical order and showing: materials of construction; arrangement of components and wiring; gasketing for weather tightness; means of mounting luminarie and adjusting aspect; finishes; photometric data with lamp or lamps specified; electrical data including volts, amperes and watts; and for roadway type luminaries, distribution data according to Illuminating Engineering Society (IES) roadway classification type.
 - 4. LED Driver and light engine, initial and mean lumen output, and color rendering index. LED drivers and related electrical characteristics and operating conditions.
 - 5. Poles and standards dimensions, details of hand holes and wire entries, mast or bracket arms and connection to poles, wind load and deflection, and finishes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers acceptable contingent upon Product's compliance with the specifications: refer to Lighting Fixture Schedules on the drawings for acceptable manufacturers of light fixtures. Acceptable Pole Manufacturers: Valmont, KW, WJM.
- B. Where lighting regulations exist by the Authority Having Jurisdiction, the Contractor shall be responsible for submission of all documentation and approval from the Authority Having Jurisdiction of the exterior lighting were alternate manufacturers are proposed other than specified. Where approval from an Authority Having Jurisdiction is required, Contractor shall submit, with those product data, confirmation of approval from the Authority Having Jurisdiction.

2.02 LUMINARIES

- A. Refer to Section 26 51 13 Lighting Fixtures and Lamps, for ballast, drivers, and lamp requirements.
- B. Provide luminaries of the sizes, type and ratings indicated, complete with housings, lenses, refractors, lamps, lamp holders, reflectors, ballasts, starters, igniters, mounting brackets or hardware with adjusting means and wiring.
- C. Provide luminaries with rigidly formed, weather and light tight enclosures that will not warp, sag, or deform in use. Provide housings free from burrs, sharp edges or corners.
- D. Provide captive hardware hinged doors, operating freely, to allow lamp installation and removal without the use of tools. Equip door mechanism to preclude accidental falling of the door when opening or closing or when secured in the closed position. Provide for door removal for cleaning or replacing lens.

- E. Provide stainless steel hinges, latches, fasteners, and hardware to prevent corrosion of hardware or the staining of adjacent surfaces.
- F. Use interior formed and supported light reflecting surfaces having reflectances of not less than 85 percent for white surfaces, 85 percent for specular surfaces, and 75 percent for specular diffuse surfaces.
- G. Use borosilicate tempered glass, lenses and refractors. Use heat and aging resistant resilient gaskets to seal and cushion lens and refractor mounting in luminarie doors.
- H. Provide finishes of the color and type indicated and having the following properties:
 - 1. Protection of metal from corrosion - 5 year warranty against perforation or erosion of the finish from weathering.
 - 2. Color retention – 5-year warranty against fading, staining, or chalking from weathering, including solar radiation.
 - 3. Provide finish of uniform thickness and color, free from streaks, stains or orange peel texture.
- I. LED sources shall meet the following requirements:
 - 1. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - 2. Color Rendering Index (CRI): ≥ 65 .
 - 3. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
- J. LED drivers shall meet the following requirements:
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Starting Temperature: -40° F.
 - 3. Input Voltage: 120 to 480 ($\pm 10\%$) V.
 - 4. Power Supplies: Class I or II output.
 - 5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 - 6. Power Factor (PF): ≥ 0.90 .
 - 7. Total Harmonic Distortion (THD): $\leq 20\%$.
 - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.03 POLES AND STANDARDS

- A. Provide poles of the types and heights indicated. Provide internal raceway for underground power supply, with luminarie support pole base indicated. Provide poles that will carry the indicated supports, luminaries and appurtenances, at the required heights above grade, without excessive deflection or whipping of the luminarie when subjected to 120 mph basic wind speed with 1.3 gust factor. Pole structural integrity shall

rely solely on the anchor bolts, nuts and washers. Pole shall not be in direct contact with concrete base or mortar.

- B. Provide metal lighting poles with steel or aluminum shaft; equipped for post top or mast arm luminaire mounting. Provide wiring access hand hole with welded ½" NC ground lug, readily accessible from hand hole opening. Provide features as follows:
 - 1. Provide a one-piece pole shaft fabricated from a weldable grade carbon structural steel tubing with a uniform thickness as required. Material shall conform to ASTM A-500, Grade C.
 - 2. Provide anchor base of the same material and finish as the pole, welded to the pole. Provide adequately sized (at least 15 square inches) hand hole with screwed cover. Provide galvanized steel hold-down or anchor bolts and leveling nuts. Provide full base cover.
 - 3. Factory prime coat with polyester powder-coat paint. Steel poles shall be hot dipped galvanized, with prime coat, with 8 mil minimum polyester powder-coat paint. Color to match light fixture.
- C. Anchor bolts:
 - 1. Provide zinc coated anchor bolts and nuts. Length shall be per pole manufacturer's shop drawings, complete with 3 inch right angle bend on one end and 6 inches of thread on the other end. Provide zinc coated flat washers, lock washers, and hexagonal nuts for each pole.
 - 2. Provide template for positioning of anchor bolts.
- D. Accessories:
 - 1. Full base covers, finish to match pole
 - 2. Hand hole with cover plate and vandal resistant hardware.

2.04 LUMINAIRE MOUNTING

- A. Provide corrosion resistant metal luminaire mounting compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mounting that will correctly position the luminaire to provide the required light distribution. Provide drill mounting to pole shaft unless specified otherwise.
- B. Provide brackets, cantilevered and without under brace, of the sizes, styles, and finishes indicated with straight tubular end section to accommodate the luminaire.
- C. Provide steel tenon only for single fixture yoke or spider post top mounting securely fastened to the top of the pole shaft, fabricated to accept and rigidly support the luminaire to be mounted thereon. Set screws shall have pole shaft drilled to prevent rotational movement.

PART 3 - EXECUTION

3.01 LIGHTING POLE INSTALLATION

- A. Contractor shall not rough-in conduit, drill or pour concrete foundations for site lighting until review of the site lighting submittals is complete. This is to ensure coordination with the current site plan paving and utilities and photometric performance of the submitted

product.

- B. Install lighting poles as follows:
1. Install lighting poles and standards as indicated, in accordance with manufacturer's written instructions, and in compliance with ANSI C2.
 2. Provide excavation and poured concrete bases using 3,000 pound 28-day concrete, and provide anchor hook-bolts, nuts and washers in conformance with the details and manufacturer's requirements. Refer to Division 3 for concrete work. Project anchor bolts 2-inches minimum above base. Use double nuts for adjustment.
 3. To protect finish, use fabric web slings (not chain or cable) to raise and set finished poles and standards.
 4. Install pole clear of contact of concrete base or mortar.
- C. Grounding: Provide equipment bonding and grounding connections, sufficiently tight to assure permanent and effective grounds. Bond all metal, non-current carrying parts to ground. Provide 25-foot #2 solid ground electrode from pole base hand holes encased in concrete pier, to bottom of concrete pier with excess ground electrode coiled at bottom of concrete pier. Secure the ground electrode to the reinforcement steel to prevent movement during concrete pour. Bond all metal parts of the pole shaft ground lug. Provide #6 electrode grounding conductor from pole base ground lug to the ground conductor, using thermal fusion (exothermic) methods.
- D. Wiring:
1. Provide Type SO cord from base of pole lights to top of poles. Do not use single conductors.
 2. Install inline fuse holders, fuses, at base of pole lights on each lighting circuit. Provide Bussman Insulating boot Catalog # 2A0660 installed over conductor terminations. Fuse size shall be as follows:

WATTAGE	# OF Fixtures	208V	240V	277V	480V
0-400	1	5	5	5	5
0-400	2	8	8	5	5
0-400	3	10	10	8	5
0-400	4	15	10	10	8
401-1000	1	10	8	8	5
401-1000	2	15	15	15	8

3. Provide Styrofoam wedge at midpoint of pole to stabilize conductor.
4. Provide strain/stress relief on SO cord at top of pole.

3.02 LUMINAIRE INSTALLATION

- A. Install exterior luminaires at locations and heights as indicated, in accordance with the manufacturer's written instructions, applicable requirements of NFPA 70, ANSI C2 and with recognized industry practices to ensure that lighting installation fulfills requirements.
- B. Fasten luminaires securely to indicated structural supports and check to ensure that the

required degree of freedom is provided to allow alignment or aiming of the fixtures for indicated light distribution.

- C. Clean exterior luminaries of dirt and debris upon completion of installation. Do not damage finishes or lens or refractor surfaces.
- D. Provide equipment grounding connections using branch circuit equipment and connected sufficiently tight to assure a permanent and effective ground.

3.03 TESTS AND DEMONSTRATIONS

- A. Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. Correct malfunctioning units, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting. Verify correct reflector types and orientation prior to final aiming.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including reflectors, plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts. Pre-aim lighting fixtures as practical prior to final aiming and adjustment.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose, as specified, as indicated and/or recommended by Manufacturer's photometric report. Re-aim and re-adjust as required to the satisfaction of the Architect/Owner, including nighttime adjustment of exterior lighting in the presence of the Architect/Owner. Provide five business day notification of proposed night-time review by Owner / Architect.

3.04 LAMP REPLACEMENT AND PROVISION OF SPARE LAMPS

- A. At time of substantial completion, replace lamps in luminaries that are observed to be not functioning properly after Contractor's use and testing. Provide spare replacement non-LED lamps amounting to 10 percent (but not less than ten lamps in each case) of each type and size lamp used in each type fixture.

END OF SECTION 26.56.00

SECTION 28.31.00
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
 - 1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
 - 2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
 - 3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
 - 4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.
- B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.02 RELATED SECTIONS

- A. Division 22 and Division 23
- B. Sprinkler Systems
- C. Elevators

1.03 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 13 Systems, Installation
 - 2. NFPA 17 Dry Chemical Extinguishing Systems
 - 3. NFPA 70 National Electrical Code
 - 4. NFPA 72 National Fire Alarm and Signaling Code.
 - 5. NFPA 80 Fire Doors and Fire Windows
 - 6. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 7. NFPA 92A Smoke Control Systems
 - 8. NFPA 101 Life Safety code.

9. NFPA 105 Smoke Control Door Assemblies
 10. NFPA 2001 Fire Extinguishing Systems, Clean Agent
- B. UL: Underwriters Laboratories, Inc.
1. 217 Single and Multiple Station Smoke Detectors.
 2. 268 Smoke Detectors for Fire Protective Signaling Services.
 3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
 4. 864 Transient protection
 5. 1480 Speakers for Fire Protective Signaling Systems
 6. UL Fire Protection Equipment Directory.
 7. UL Electrical Construction Materials Directory.
- C. Uniform Federal Accessibility Standards (UFAS).
- D. Factory Mutual P7825 Approval Guide
- E. American National Standards Institute (ANSI).
- F. National Electrical Manufacturer's Association (NEMA).
- G. Institute of Electrical and Electronic Engineers (IEEE).
- H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- I. Requirements of American Disabilities Act (Public Law 101-336).
- J. Local Accessibility Standards
- K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- L. State Insurance Code
- M. International Building Code Adopted by Local Authority Having Jurisdiction
- N. Local & State Building Codes
- O. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.
- 1.04 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS
- A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.
- B. Manufacturer's product shall have been in satisfactory operation on three installations of

similar size, type and design as this project, for approximately 3 years.

- C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.
- D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.
- E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.
- F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.
- G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.
- H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.
- I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.
- J. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose.
- K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Louisiana Board of Professional Engineers.
- L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- M. Material shall be new and in perfect condition when installed.
- N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.
- O. Quality Control Assurance:
 - 1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial

- listing shall not be acceptable.
- 2. All components of the fire alarm systems shall use the most current technology available.
- 3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.
- 4. All devices shall be tested and certified that they meet or exceed the "Service Life Expectancy Rating" as outlined by UL and NFPA.

1.05 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.
- B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.06 DEFINITIONS

- A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
 - 1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
 - a. The operation of a manual station.
 - b. The operation of a fire suppression system switch.
 - 2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require an immediate response, but do not require immediate notification of the Fire Department.
 - 3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
 - 4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
 - 5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
 - 6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
 - 7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
 - 8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.07 SUBMITTALS

- A. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.

- B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).
- C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
 - 1. Name of Owner and Occupant
 - 2. Date
 - 3. Location, including street address.
 - 4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
 - 5. Device Legend
 - 6. Input/output programming matrix
 - 7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
 - 8. Battery calculations
 - 9. Notification appliance circuit voltage drop calculations
 - 10. Floor Plan
 - a. Floor identification
 - b. Point of compass
 - c. Correct graphic scale
 - d. All walls and doors
 - e. All partitions extending to within 15 percent of ceiling height
 - f. Room descriptions
 - g. Fire alarm device / component locations
 - 1) Signal notification devices
 - 2) Initiation devices
 - 3) Smoke control systems
 - 4) Initiation of automatic extinguishing equipment
 - 5) Doors that unlock or close automatically
 - 6) Zone verification for detection devices
 - 7) Fire/Smoke damper control
 - 8) Fire alarm panel location
 - 9) Fire alarm annunciators
 - 10) Control valves to Fire Protection System
 - 11) Duct smoke detectors
 - 12) Supervisory devices
 - 13) Elevator location
 - 14) Elevator recall system location
 - h. Location of fire alarm primary power connections
 - i. Location of monitor/control interfaces to other systems
 - j. Riser locations
 - k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
 - l. Ceiling height and ceiling construction details
 - m. Fire alarm system riser diagram
 - 1) General arrangement of the system, in building cross-section
 - 2) Number of risers

- 3) Type and number of circuits in each riser
- 4) Type and number of fire alarm components/devices on each circuit, on each floor or level
11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
 - a. Identification of control equipment depicted
 - b. Location(s)
 - c. All field wiring terminals and terminal identification
 - d. All indicators and manual controls, including the full text of all labels
 - e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
 - f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
12. Complete system bill of material of all hardware components.
13. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
15. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
16. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
18. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
19. Sample of proposed graphic/text annunciation.

1.08 OPERATION AND MAINTENANCE MANUALS

- A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.
- B. The Operation and Maintenance Manual shall consist of the following:
 1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
 2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
 3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures,

- manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
 5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
 6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
 7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.09 AS-BUILT DRAWINGS

- A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 OPERATIONAL INSTRUCTIONS

- A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
 1. Notifier – Notifier Engineered Systems Distributor
 2. Edwards EST3/EST3X - Local Strategic Partner
 3. Farenhyt – Authorized Farenhyt Distributor / Installer

4. Cerberus PRO – Authorized and Certified Solutions Partner
5. Siemens Building Technologies, Inc. XLS-V – Authorized and Certified Solution Partner
6. Simplex Grinnell, Local Simplex District Office Distributor
7. Gamewell – Authorized Gamewell Systems Distributor

2.02 SYSTEM DESCRIPTION

- A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.
- B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
 1. Alarm
 2. Trouble.
 3. Open
 4. Short
 5. Device missing/failed.
- C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.
- D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.
- E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.
- F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- G. Auxiliary manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble.
- H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.
- I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.

- J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.
- K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
- L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.
- M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.
- N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.
- O. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.
- P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.
- R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.
- S. Each panel extender shall have an individual address.

2.03 FIRE ALARM CONTROL PANEL (FACP)

- A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500

addressable points.

- B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.
- C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.
- D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.
- E. The following primary controls shall be visible through a front access panel:
 - 1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
 - 2. Individual red system alarm LED.
 - 3. Individual yellow supervisory service LED.
 - 4. Individual yellow trouble LED.
 - 5. Green "power on" LED.
 - 6. Alarm acknowledge key.
 - 7. Trouble acknowledge key.
 - 8. Alarm silence key.
 - 9. System reset key.
- F. Under normal condition, the front panel shall display a "SYSTEM IS NORMAL" message and the current time and date.
- G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- H. The alphanumeric display shall provide the following information relative to the abnormal condition of a point in the system.
 - 1. 40-character custom location label.
 - 2. Type of device (i.e. smoke, pull station, water flow).
 - 3. Point status (i.e. alarm, trouble).
 - 4. Addressed device physical location to correspond to the actual graphic room numbers. Where devices are located in hallways, corridors, or large spaces, the location shall include the hallway, corridor, or large space and in addition reference to the nearest room or other physical object recognizable by the Owner. Example (smoke detector, alarm, Corr 123 by Rm 789), exact format and abbreviations as directed by Owner to fit the panel display format.

- I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.
- J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.
- K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, "END of LIST".
- L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.
- M. Alarm silencing:
 - 1. Should the "Alarm Silence" button be pressed, all audible alarm signals shall cease operation.
 - 2. Visual signals shall not be extinguished during alarm silence inhibit mode.
- N. System reset:
 - 1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
 - 2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
 - 3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.
- O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
 - 1. HVAC - Bypass
 - 2. Indicating appliance circuits bypass
 - 3. Auxiliary relays points bypass
 - 4. All other input/output points.
- P. The following status data or their equivalent shall be available:
 - 1. Primary state of point.
 - 2. Device, PID and card type information.
 - 3. Current priority of outputs.

4. Disable/enable status.
 5. Verification tallies of initiating devices.
 6. Automatic/manual control status of output points.
 7. Acknowledge status.
 8. Relay status.
- Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.
- R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.
- S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
 2. LED testing.
 3. Alarm, trouble, and abnormal condition listing.
 4. Enabling and disabling of each monitor point separately.
 5. Activation and deactivation of each control point separately.
 6. Changing operator access levels.
 7. Walk test enable.
 8. Running diagnostic function.
 9. Displaying software revision level.
 10. Displaying historical logs.
 11. Displaying card status.
 12. Point listing.
 13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
 - a. All points list by address.
 - b. Monitor point list.
 - c. Signal list.
 - d. Auxiliary control list.
 - e. Feedback point list.
 - f. LED/switch status list.
 14. Fire Drill:
 - a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
 - b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
 - c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
 15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
 16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and

- prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.
17. The system shall be capable of being tested by one person. The actuation of the “enable walk test” program at the fire alarm control panel shall activate the “Walk Test” mode of the system, which shall cause the following to occur:
- a. The remote monitoring circuit connection shall be bypassed.
 - b. Control relay functions shall be bypassed.
 - c. The control panels shall show a trouble condition.
 - d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
 - e. The panel shall automatically reset itself after signaling is complete.
 - f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
 - g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
 - h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.
- a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual “*” in the 80 character display.
 - b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
 - c. Should an invalid code be input, access shall be denied.
 - d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
 - e. The following keys/switches, or their equivalent shall have access levels associated with them:
 - Set time/date.
 - Manual control
 - Disable/enable
 - Clear historical alarm log
 - Clear historical trouble log
 - Walk test
 - Change alarm verification
 - f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
 - Alarm Silence
 - System Reset
 - Acknowledge

19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
 - a. The following Historical Alarm log events shall be stored:
 - Alarms
 - Alarm acknowledgment
 - Alarm silence
 - System reset
 - Alarm historical log cleared
 - b. The following historical trouble log events shall be stored:
 - Trouble conditions
 - Supervisory alarms
 - Trouble acknowledgment
 - Supervisory acknowledgment
 - Alarm verification tallies
 - Walk tests results
 - Trouble historical log cleared
23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED "ON" indicating the off-normal condition.

26. Activation of an auxiliary bypass key shall override the selected automatic functions.
 27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
 28. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.
- T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.
- U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.
1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
 2. Surge protection shall be integral to the control panels.
 3. Each power supply shall be monitored and have an individual address.
- V. Digital Fire Alarm Communicator:
1. Two line primary and secondary telephone line connections
 2. Automatically seizes telephone line.
 3. Automatic verification between panel and receiving station.
 4. Transmits common trouble and supervisory conditions.
 5. Dialer status LED.
 6. Multiple communication formats including Ademco Contact ID.
 7. Dual tone multi-frequency (DTMF) or Pulse modes.
 8. Programming password protected.
 9. UL approved.
- W. IP Internet and Digital Cellular Communicator:
1. UL 864 listed
 2. Supervise IP Ethernet connection every 90-seconds or less
 3. Upload/Download capable
 4. Transmit all signals and information from the DTMF communicator
- X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors

shall be capable of "Day-Night" automatic sensitivity adjustments.

- Y. Control Switches:
 - 1. Acknowledge/step Switch
 - 2. Signal Silence Switch
 - 3. System Reset Switch
 - 4. System Test Switch
 - 5. Lamp Test

- Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

- AA. Emergency voice alarm communication system:
 - 1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
 - 2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
 - 3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
 - 4. The Voice Communications System shall be able to detect a brownout condition

- on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
 6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eeproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
 7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.
 8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.04 FIELD DEVICES

- A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.
- B. Visual Signals:
 1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
- C. Combination Alarm Signal and High Intensity Visual Signals:
 1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and

- areas of high ambient noise level. Provide white with red letters.
2. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.
- E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
 2. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a xenon strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
 3. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33/.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.
- F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.
- G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.
- H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual

stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present.

I. Intelligent Photoelectric Smoke Detectors:

1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
2. The detectors shall provide address-setting means electronically and automatically at the control panel and programmed for alarm verification.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Duct photoelectric smoke detectors:

1. Detectors shall be analog addressable type.
2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED

- shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
9. The detectors shall provide address setting means electronically and automatically from the control panel and programmed for alarm verification.
- K. Intelligent Thermal Detectors:
1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
 2. The detectors shall provide address-setting means electronically and automatically at the control panel.
 3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
 4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.
 5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
 6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.
- L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector's alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
 2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
 3. Electro-chemical CO detection.
 4. Integral 85db local alarm with local hush/test switch for silence or test.
 5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.
- M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.
- N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.
- O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
 2. The monitor module shall provide address-setting means electronically and

automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.

P. Control Module

1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.

Q. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.

R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

2.05 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor the status of the following equipment when provided as part of this project. A failed status shall activate the trouble alarm.
1. Emergency generator: Run Status
 2. Emergency generator: Trouble Signal
 3. Fire Pump: Run Status
 4. Fire Pump: Trouble Signal

2.06 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

- A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.
- B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
 2. Permit the automatic roll down fire doors/shutters to close automatically.

3. Permit the security grilles with emergency egress to open automatically.
 4. Unlock the electrically controlled access doors in all interior spaces.
- C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.
- D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.07 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

- A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an alphanumeric display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time-date clock
 2. System reset
 3. System silence
 4. System acknowledge
 5. Display/step switch
 6. Integral trouble buzzer
 7. LCD contrast adjust
 8. Fire Drill Operation
- B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
 2. Individual red system alarm LED
 3. Individual yellow supervisory service LED
 4. Individual yellow trouble LED
 5. Green "POWER ON" LED
 6. Alarm acknowledge key
 7. Trouble acknowledge key
 8. Alarm silence key
 9. System reset key
 10. LED test

2.08 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.
- B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.
- C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.
- D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.
- E. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.
- F. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.
- G. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.
- H. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.
- I. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.
- J. Provide remote alphanumeric display annunciators in the administrative area in

constantly attended area and additional annunciators where indicated on the drawings.

- K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.
- L. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.
- M. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.
- N. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
- O. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
- P. Power for magnetic door holders shall be wired through fire alarm relay.
- Q. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.
- R. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: "120-Volt Circuit ELA-3")
- S. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
- T. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.
- U. Provide manual pull stations at each exterior exit and at each exit from all floors. Provide one manual pull station at the central reception area as directed by Owner.
- V. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
 - 1. Main entry.
 - 2. Courtyards and outdoor assembly areas adjacent to the building.
 - 3. Mechanical yards adjacent to the building.
 - 4. Covered playgrounds or covered assembly areas adjacent to the building.
 - 5. Additional locations where indicated on drawings.
 - 6. Outdoor paved play areas.

3.02 CABLE AND BOXES INSTALLATION

- A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum 18 AWG wire size for data communications, minimum 14 AWG wire size for alarm circuits.
- B. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- C. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.
- D. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.
- E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- F. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.
- G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- H. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.
- I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.
- J. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.
- K. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- L. All junction boxes containing fire alarm wiring are to be painted red and labeled.
- M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable in D-ring hangers, secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.

- N. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.
- O. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- P. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.
- Q. No other wiring shall be run in the same conduit as fire alarm wiring.

3.03 FINISHES

- A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

3.04 ALARM SYSTEM SEQUENCE OF OPERATION

- A. General:
 - 1. All fire alarm circuits shall be electrically supervised.
 - 2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.
- B. Fire alarm operating sequences shall be as follows:
 - 1. Activation of any automatic detector, manual station, or sprinkler flow switch shall cause the location of alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
 - a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
 - b. The alphanumeric display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
 - c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
 - d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and

- service provided by Owner). Point ID and descriptor must be sent and received.
- e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
 - f. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
 - g. De-activate all HVAC systems.
 - h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
 - i. Close all related smoke dampers.
 - j. Close all related smoke/fire dampers.
 - k. Release all magnetic door hold open devices.
 - l. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
 - m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
 - n. Open all security grilles with emergency egress.
 - o. Activate to close all related fire and smoke doors and shutters.
 - p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
 - q. Signal the building automation system and security system, and Owner's security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged and appropriate action has been taken.
 - r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.
3. Activation of a control valve supervisory switch shall initiate the following events:
- a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
 - b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
 - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.
4. Activation of the smoke detector and heat detector in the elevator machine room

- and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
 6. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.
- C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.
- D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.05 EQUIPMENT IDENTIFICATION

- A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
1. Name of manufacturer.
 2. Manufacturer's equipment description.
 3. Serial number and model number.
 4. Voltage and current rating.
- B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Verify exact requirements with Owner.

3.06 SPARE PARTS AND TOOLS

- A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.
- B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
1. Spare shut down modules
 2. Spare detectors of each type in the system
 3. Spare alarm indicating devices of each type in the system
 4. Spare manual pull stations
 5. Spare protective covers of each type in the system.
 6. Spare relays/controls required for connection to smoke and fire/smoke dampers
 7. Devices listed above are to be installed as directed by Architect/Engineer or local

code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.

- C. Provide two copies of the final software programmed into the fire alarm system.
- D. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.07 KEYS

- A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.08 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

- A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.
- B. Coordinate motor operator voltage with supplier.
- C. Open all dampers prior to starting air handling equipment.
- D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.09 GRAPHIC FLOOR PLANS

- A. Provide two (2) color coded floor plan detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator. Indicate location of all end-of-line resistors.
- C. The floor plan shall be solvent welded in acrylic plastic.
 - 1. Mount in an extruded aluminum frame next to the main fire alarm control panel and annunciator in main office. Minimum size 30x42 inches. Coordinate exact location with Architect / Owner.
 - 2. Provide a minimum 1 inch x 17 inch graphic print of building showing all rooms by graphic room numbers. Print shall show all detectors, major equipment and active detection devices. Print shall be framed in an extruded aluminum frame (24"x36") with clear plastic cover. Graphic shall be prepared in AutoCad version 2011 or newer. Data file (xxx.dwg) of graphic shall be provided as a part of the project.

- D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 OPERATING INSTRUCTIONS

- A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.
- B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
 - 1. Alarm Signal
 - a. How to open panel door
 - b. What to read and follow the instruction on display
 - c. How to acknowledge alarm
 - d. How to silence the signals
 - e. How and when to reset the system
 - f. How to return system to normal operation
 - 2. Trouble / Supervisory
 - a. How to open panel door.
 - b. What to read and follow the instruction on display
 - c. How to acknowledge trouble condition
 - d. Appropriate personnel to respond
- C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

- A. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.
- B. Coordinate door hold devices with door and door hardware.
- C. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.
- D. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
- E. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

3.12 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be

responsible for insuring that all elements function together as a system in accordance with the specifications.

- B. A state licensed NICET II minimum and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.
- C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72. Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.
- D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner prior to testing for the local Fire Marshall.
- E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
 - 1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
 - 2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
 - 3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
 - 4. Indicators shall be tested to ensure proper function and operation.
 - 5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
 - 6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
 - 7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.

8. Manual initiating devices:
 - a. Each manual fire alarm station shall be functionally tested for alarm operation.
 - b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
 9. Automatic initiating devices:
 - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
 - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
 - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
 10. Alarm signaling devices:
 - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
 - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
 - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
 - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
 11. Elevators: Each elevator shall be tested and automatic recall function verified.
 12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.
- H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.
- 3.13 SUBSTANTIAL COMPLETION
- A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.
 - B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.
 - C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

- A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and remote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.
- B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
- C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
- E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.
- F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of "As-Built" drawings and schematics of all equipment.
- G. All manufacturer's warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

- A. Provide training course to all fire personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
- B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.
- C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.

- D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

3.15 FACTORY TRAINING

- A. Training:
1. Provide factory training for one person for the following:
 - a. Instruction of Operation and Maintenance & Service
 - b. Certification service and troubleshooting.
 - c. Software training on programming
 - d. Certification programming
 - e. Two-week basic & in-depth class
 2. Provide the following for each of the Owners' representatives:
 - a. Round trip air and ground transportation from Bush Intercontinental Airport
 - b. Individual rooms at a first class hotel/motel
 - c. Three meals per day
 - d. Required ground transportation between lodging and the training facility.

END OF SECTION 28.31.00

SECTION 31 23 23 SELECT FILL AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.
- B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2009.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- I. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 SELECT FILL MATERIALS

- A. Select Fill - Mississippi River pump sand or approved equal.
- B. Sand - Fill Type Mississippi River pump sand.: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. Acceptable ASTM D2478 grades: GW, GP, GM, SM, SW, and SP.
 - 2. Maximum plasticity index = 25.
 - 3. Maximum liquid limit = 45%
 - 4. Free of roots, clay lumps, or other deleterious material
 - 5. Less than 10% passing No. 200 sieve
 - 6. Maximum organic content = 5% by weight.

2.02 ACCESSORIES

- A. Vapor Retarder: See Cast in Place Concrete 03 30 00

2.03 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. Verify subdrainage, damp proofing, or waterproofing installation has been inspected.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with select fill. as required by Section 3.3 Filling of this Specification.
- C. Compact any disturbed subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.
- E. Comply with any other directions of applicable project Geotechnical Report.
- F. Sheet piling, shoring, and associated excavation shall be performed in accordance with OSHA guidelines and is the Contractor's responsibility.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
- G. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- H. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
- I. Comply with any other directions of applicable project Geotechnical Report.
- J. Backfill both sides of all foundation and retaining walls equally until low side is up to finish grade. Do not backfill any walls until concrete has reached its specified 28-day compressive strength.

3.04 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL

- A. Perform in situ compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("Modified Proctor")
- C. If tests indicate work does not meet specified requirements, remove work, replace, and retest.
- D. Frequency of Tests: 1/250 s.f or 1/25 l.f. trench.
- E. Testing agency shall be retained by the Owner or Contractor.

3.06 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 23 33
TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Trenching and backfilling of utility trenches
- B. Quality control on site
- C. Cleaning upon project completion

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. Sand - Fill Type Mississippi River pump sand.: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.03 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.

- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excavated material that is unsuitable for re-use from site.
- G. Stockpile excavated material to be re-used in area designated on site in accordance with landscape specifications and the Geotech report.
- H. Remove excess excavated material from site.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
- G. Slope grade away from buildings a minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving and similar construction: 95 percent of maximum dry density.
 - 2. At below pile supported areas: 85 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

3.06 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: 1/2500.

3.08 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

3.09 PAYMENT

- A. No separate measurement or payment will be made for services or products related to all trenching for site utilities. All costs in connection to this section shall be included in the contract prices for the items of work to which the work is incidental.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK TO BE PERFORMED

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including, but not limited to, the following:
 - 1. The work to be performed is shown on the Drawings listed on the contract from. The work shall be performed in accordance with Louisiana Department of Environmental Quality (LDEQ) and the Environmental Protection Agency (EPA).
 - 2. Furnish and install all slope protection, sedimentation and erosion control measures as necessary to retain all erosion and sediments within the construction area, as shown on the Drawings and/or as specified herein, including, but not limited to:
 - A. Provide and maintain hay bales or erosion control silt fence for control of soil runoff on exposed slopes, drainage structures and temporary stockpiles.
 - B. Seeding annual ryegrass, installing erosion control blankets, or temporary mulch as a temporary cover on all exposed slopes and stockpiled topsoil.
 - C. Providing stone construction entrance pads to site and cleaning adjacent roadway surfaces of all accumulated sediment and debris as required or a minimum of once per week.
 - D. Temporary settling basins.
 - E. Erosion Control Blankets (ECB) on all key identified slopes.
 - F. Temporary seeding and lawn stabilization of disturbed areas.
 - G. Dust control.
 - H. Provide and maintain drain inlet Sediment Control Bags at all existing or new catch basins to which runoff from the construction site contributes to.
- B. The following Related Work is specified under the designated Sections:
 - 1. Section 31 10 00 – SITE PREPARATION
 - 2. Section 31 00 00 – EARTHWORK
 - 3. Section 32 12 16 – BITUMINOUS CONCRETE PAVING
 - 4. Section 33 00 00 – SITE UTILITIES

1.03 QUALITY ASSURANCE

- A. Material Standards and Standards of Workmanship: Equal to the Commonwealth of Massachusetts Guidelines for Soil Erosion and Sediment Control and Local Town Requirements.
- B. Requirements specified and noted on drawings are minimum. Provide additional measures as required by the local, State or Federal authorities as a result of Contractor's specific scheduling and Work sequencing, or weather conditions at no additional cost to the Owner.
- C. Qualifications: Engaged firm shall be able to demonstrate experience in the installation of the erosion and sedimentation controls described in the Contract Documents.

1.04 SUBMITTALS

- A. A. Product data for the following:
1. Silt Fence
 2. Erosion control blankets.
 3. Soil stabilizers.
 4. Sediment Control Bags.
 5. Fertilizers, seed.
 6. Limestone.
 7. Chemical preservatives and controls – also confirm that each of the materials proposed to be applied are permitted within the Commonwealth of Massachusetts and the Town of Deerfield.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Seed, Fertilizer and Lime: Deliver in original sealed, labeled, and undamaged containers, showing weighs, analysis, and name of manufacturer.
- B. Protect materials from deterioration during delivery and while stored at site.

1.06 COORDINATION AND SCHEDULING

- A. General: Sow lawn seed and install all stabilization measures as soon as possible in accordance with the Contractor's schedule.
- B. Weather Limitations: Proceed with lawn development only when existing and forecast weather conditions are suitable for work.

1.07 MAINTENANCE

- A. Begin maintenance of stabilized areas immediately after each area is stabilized and continue until project is accepted.
- B. Maintain and establish all disturbed areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth lawn.
1. Replant bare areas.
 2. Add new mulch and tackifier in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.

1.08 JOB CONDITIONS

- A. Existing Conditions: The contractor shall examine all work that the work of this Section is contingent upon, and report any deficiencies to the Architect. Commencement of the work will be construed to mean complete acceptance by the Contractor of the preparatory work of others. No adjustment will be made for discrepancies brought to the Architect's attention after work has begun.

1.09 PROTECTION OF ADJACENT LANDS

- A. The Contractor shall be totally responsible for protection of any lands or properties as may be subject to any effect or by-product of his demolition/construction effort. Special care shall be

taken to avoid erosion of fill or cut slopes onto adjacent properties or downstream siltation of diversion of existing surface drainage. Any damage is to be corrected immediately.

- B. Erosions control measures in the locations shown and as detailed and described in the Contract Documents shall be considered minimum requirements and the Contractor shall take whatever other erosion and sedimentation controls steps necessary to accommodate his particular construction procedures.

1.10 SCHEDULE PROCEDURE

- A. Erosion control construction shall be done prior to the commencement of demolition, site preparation or earthwork operations. The initial method outlined herein is intended to route all practicable surface water from the excavation area into erosion control facilities. The Contractor shall install any additional protective measures as may be required to control siltation from the site.
- B. The following sequence of construction shall be followed: Revisions shall be only with the approval of the Architect and the responsible municipal governing agency.
 - 1. Place sedimentation control measures along slopes, at catch basins and across swales and outfalls as shown on the Drawings, and where directed by the Architect.
 - 2. Proceed with construction of the remaining items of work in accordance with the approved project sequence and schedule. The contractor shall be responsible for maintaining the integrity of all sediment and erosion control measures for the duration of the Contract.
 - 3. Clean and maintain all sedimentation control components to achieve the intended purpose of both temporary and permanent erosion and sediment control facilities.

PART 2 PRODUCTS

2.01 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerance.
 - 1. Seed Mixture: 50% Annual Ryegrass; clean with a minimum of 0.50% noxious weed seed; minimum 97% pure with a germination rate minimum of 80%.
 - 2. If seeding occurs after September 15, substitute winter rye for annual rye grass.
- B. Straw Mulch: Provide air-dry, clean, mildew-and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- C. Fiber Mulch: Biodegradable dye-wood cellulose-fiber mulch, nontoxic, free of plant growth or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth-or germination-inhibitors.

2.02 EROSION-CONTROL MATERIALS

- A. Standard Size Bales of hay or straw, having no loose or decomposed baling twine.
- B. Erosion Control Blanket: C125BN coconut fiber erosion control blanket (100% biodegradable) as manufactured by North American Green or approved Equal. Include biodegradable stakes. C. Temporary Mulch: Straw hydromulch or other approved product.
- C. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb. Per sq. yd. (0.5 kg per sq.

m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150mm) long.

2.03 SILTATION FENCE

A. Silt fence shall consist of the following elements:

1. Fabric for siltation fence shall be a minimum width of 3 feet and conforming to the following criteria:

MINIMUM ACCEPTABLE		
<u>Fabric Properties</u>		<u>Test Method</u>
Grab Tensile Strength (lbs)	124	ASTM D 4632
Grab Tensile Elongation (%)	15	ASTM D 4632
Mullen Burst Strength (psi)	300	ASTM D 3786
Puncture Strength (lbs)	65	ASTM D 4833
Flow Rate (gal/min/sf)	10	ASTM D 4491
Apparent Opening Size (sieve)	30	ASTM D 4751
Ultraviolet Stability (% strength retained)	70	ASTM D 4355

2. Acceptable fabric materials include "Mirafi Envirofence" by TenCate Mirafi, "Style 2130" by Amoco Fabrics Co., and "LS125-Super Grade" by ACF Environmental, or as approved by the Engineer.
3. Silt fence posts shall be wood or metal. Wood posts shall be a minimum of 1½ inch by 1½ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch diameter and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.
4. Furnish and install suitable nylon cord to secure abutting silt fence posts.

2.04 CRUSHED STONE: Conform to MHD, Section M2.01.1, gradation 2".

PART 3 EXECUTION

3.01 CONSTRUCTION ENTRANCE

- A. Install construction entrances to each project work area and staging area. Location and number of entrances to be modified based on Contractor's specific sequencing of work and as approved by the Architect. Maintain each entrance by regrading and providing additional stone as required to maintain a clean and open surface.
 1. Dimensions: 50' length minimum (typical), 6" depth of crushed stone. Refer to Contract Drawings.
 2. Adjacent pavements are to be kept clean of construction generated sediment and debris. Sweeping shall occur once per week at a minimum or more frequently if so required.

3.02 TEMPORARY SETTLING BASINS

- A. A. Construction temporary settling basins and install erosion control devices washer indicated and around existing and proposed drainage structures in accordance with manufacturer's installation and recommendations. Make any adjustment to location as required by field condition, the Architect, or local Town officials. Install erosion control at limits of grading and topsoil stripping elevations. Do not allow any sediment to enter existing drainage piping systems or wetlands.

3.03 MAINTENANCE

- A. All erosion control measures are to be inspected on a weekly basis and after each rain event resulting in greater than or equal to 0.25 inches per 24-hour period by a designated employee of the General Contractor. The Contractor shall maintain inspection and maintenance logs on site at all times.
- B. Maintain basins and Erosion control devices by restaking and replacing as required. Remove buildup of silt as necessary or as directed by the Architect. Maintain operations until all lawn/planted areas are stabilized and all paving is completed.

3.04 TEMPORARY SEEDING

- A. Seed all exposed slopes and stockpiled topsoil with winter or annual ryegrass at a rate of two (2) pounds/1,000 sq. feet of area. Seeding shall be done immediately after rough grading operations are complete and maintained until finish grading and seeding have begun.

3.05 HYDROMULCHING/HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and maximum 10% of fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.
 - 1. Mix slurry with nonasphaltic tackifier.
 - 2. Apply slurry uniformly to all area to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb. Per are (5.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1200 lb. Per acre (11 kg per 100 sq. m).

3.06 TEMPORARY EROSION CONTROL FABRIC OR MULCH

- A. Temporary Erosion Control Fabric or Mulch: Immediately upon formation of rough grades, install on all key identified slopes as per manufacturer's recommendations or slopes steeper than one foot vertical to three feet horizontal or any areas and drainage swales which receive concentrated run-off water and areas that are susceptible to erosion as required by the Architect. Overlap joint of erosion control blankets one foot and secure as recommended by the manufacturer. Maintain until permanent vegetative cover is established.

3.07 CLEAN UP

- A. Upon stabilization of all disturbed areas and the completing of construction activity, remove all erosion control devices including stone construction entrances and restore surrounding areas to acceptable conditions.

END OF SECTION

SECTION 31 25 10
ENVIRONMENTAL PROTECTION AND STORMWATER POLLUTION PREVENTION

PART 1 GENERAL

1.01 GENERAL CONSTRUCTION REQUIREMENTS

- A. The Contractor shall comply with federal, state, and local laws and regulations controlling pollution of the environment, including air, water and noise. The Contractor shall take precautions to prevent pollution of waters and wetlands with fuels, oils, asphalts, chemicals or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.
- B. The Contractor certifies under penalty of law that he understands and will abide by the terms and conditions of the following:
 - 1. Permit LAS000301: Municipal Separate Storm Sewer System MS4 Permit (LAS000301) for the Orleans Parish area. This permit requires a Stormwater Pollution Prevention Plan (SWPPP) for applicable activities;
 - 2. Permit LAR200000: Stormwater Discharges from Construction Activities from 1 to less than 5 acres (when applicable). This permit requires a SWPPP;
 - 3. Permit LAR100000: Storm Water Discharges from Construction Activities from 5 acres or more (when applicable). This permit requires a SWPPP;
 - 4. Section 54-154.1 of the New Orleans Municipal Code.
- C. The use of erosion control features or methods other than those in the contract shall be as directed.
- D. The Contractor's Storm Water Pollution Prevention Plan shall be comprised of all relevant components specified in the U.S. Environmental Protection Agency document entitled, "Storm Water Management for Construction Activities", and shall include Section 3, Temporary Erosion Control, the City of New Orleans General Specifications along with applicable supplemental specifications, special provisions, and the plans.
- E. Construction operations in rivers, streams, lakes, tidal waters, reservoirs, canals and other impoundments will be restricted to areas where it is necessary to perform filling or excavation to accomplish the work and areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, streams and impoundments shall be cleared of obstructions placed therein or caused by construction operations.
- F. Frequent fording of waterways with construction equipment will not be permitted.
- G. No residue from dust collectors, concrete mixers, vehicle wash racks, or entrance/exit debris shall be dumped into a stream or drainage structure. Attention is further directed to the federal, state and local air pollution control programs and their rules and regulations regarding air pollution, especially open burning, fugitive dust and asphaltic concrete plant restrictions. The Contractor shall maintain and operate equipment to minimize noise and vibration. Engines shall be equipped with properly functioning mufflers. The Contractor shall assure the activities near noise and vibration sensitive areas, such as churches, hospitals and schools are not unduly disruptive.

1.02 REQUIREMENTS FOR NEW CONSTRUCTION AND DEQ PERMITS

UNDER ONE ACRE DISTURBED (Approx. ½ square block)	FIVE ACRES OR MORE DISTURBED
. Storm Water Control Measures (SCMs) in place. (SCMs formerly known as BMP) . NOI (Notice of Intent) not required. . Complete Inspection Reports and submit one copy to DPW. Contractor and inspector should keep a copy on file.	. SCMs in place . Must have NOI completed, sent to DEQ, and posted. . Must prepare SWPPP, post prominently . Must have General Permit posted on site with DEQ permit number for specific site.
ONE TO FIVE ACRES DISTURBED	
. SCMs in place . Must prepare SWPPP, post prominently . Must have General Permit posted on site . NOI not required. . Complete All Req'd. Reports and submit them to DPW	. Must complete Notice of Termination (NOT) and submit to DEQ.

A. COMPLIANCE WITH DEQ PERMITS

1. This work consists of constructing and maintaining the SWPPP (Storm Water Pollution Prevention Plan) and Storm Water Control Measures (SCMs) for all construction sites which include clearing, grading, construction or excavation.

B. REQUIRED STEPS FOR DISTURBED SITES EXCEEDING ONE (1) ACRE

1. Prepare a STORM WATER POLLUTION PREVENTION PLAN (SWPPP). This program will show how the Contractor will control runoff from the construction site. The basic idea is to KEEP all soil, dirt and pollutants within the limits of the site. (NOTE: AN EROSION CONTROL PLAN SHEET IS NOT A SWPPP.)

2. Typical parts of the SWPPP include:

A. Site description and endangered species in the area.

B. Controls to be used to reduce pollution.

- 1) Storm Water Control Measures (SCMs)
- 2) Sediment and Erosion Controls to be installed.

C. Inspections and Record Keeping.

D. Site Notice.

E. Certification.

3. Submit a NOTICE OF INTENT (NOI) to DEQ. For LARGE construction sites (larger than 5 acres.) The Contractor has authority to begin as per DEQ permit 48 hours after the postmark date on the NOI.
4. Put up the SITE NOTICE at the construction site.
5. INSTALL all erosion control structures (SCMs) BEFORE starting construction
6. MAINTAIN all SCMs during construction and mark any changes on the SWPPP.
7. INSPECT all SCMs as indicated in the SWPPP and make any needed corrections or changes to the construction site.
8. Procedure depending on site size

A. For SMALL sites (less than 1 acre), INSTALL SCMs. Inspect, maintain, and keep records.

- B. For MEDIUM construction sites (larger than 1 acre and less than 5 acres), after construction is completed and the soil has been stabilized, fill out a Completion Report and submit it to DPW project manager.
- C. For LARGE construction sites (larger than 5 acres), after construction is completed and soil has been stabilized, fill out a Notice of Termination (NOT) and submit NOT to DEQ (same address as shown below)
- C. Inspection: Contractor shall inspect and repair or replace, as needed, all job site SCMs at the minimum frequency (whichever of the following occurs first): weekly; before, during, and after a major rain event; or as necessary.
 - 1. Contractor shall document each inspection in the SWPPP.
- D. Permits: Permits are required for any clearing, grading, construction or excavation which is larger than 1 acre. The Contractor is responsible to obtain coverage under the Storm Water General Permit with DEQ (Office of Environmental Service, PO Box 4313, Baton Rouge, LA 70821-4313).
- E. Activities EXEMPT from the required permit include:
 - 1. Clearing of land SOLELY for agriculture purposes,
 - 2. Oil and gas exploration, production, processing, transportation or treatment,
 - 3. Repaving roads and reworking utilities and pipelines unless more than 1 acre is disturbed,
 - 4. Routine maintenance performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility (include culvert replacement, road patching, shoulder grading, pothole filling, road replacement without adding lanes, tree/brush removal)
- F. Copies of the required DEQ permits shall be submitted to the Owner and the Department of Public Works.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PAYMENT

- A. Unless otherwise specified below, No direct payment shall be made for obtaining and maintaining the necessary permits, preparation, installation and inspection of the Storm Water Control Measures (SCMs) including all labor equipment or materials required to complete the Storm Water Management Program (SWPPP).

3.02 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) and STORMWATER CONTROL MEASURES (SCMs)

- A. The Contractor shall prepare and maintain a Storm Water Pollution Prevention Plan (SWPPP), which describes in specific details the Contractor's program to prevent contamination of the storm water collection system for this project. A suggested Template and Sample SWPPP Inspection Report, as well as other valuable information can be found at EPA's website <http://cfpub.epa.gov/npdes/stormwater/swppp.cfm>.
- B. Contractor shall implement, maintain, and inspect all erosion and sediment controls identified in the SWPPP. The program shall address both common construction activities and extraordinary events. The Contractor shall remove all temporary SCMs, such as silt fences, catch basin filters, wash areas, etcetera at the end of construction.

- C. Contractor shall include Water Pollution Control Drawings (WPCD) in the SWPPP to illustrate the locations, applications, and deployment of the Storm Water Control Measures (SCMs) identified in the SWPPP. The WPCDs shall be included as an attachment to the SWPPP.
- D. Storm Water Control Measures (SCMs): The Storm Water Control Measures (SCMs) are techniques, processes, activities, or structures used to reduce the pollutant content of a storm water or non-storm water discharge. SCMs may include simple, non-structural methods such as good housekeeping, staff training, and preventive maintenance. Additionally, SCMs may include structural modifications such as the installation of berms, canopies, or treatment control.
- E. The Contractor shall comply with laws, rules, and regulations of the State of Louisiana and agencies of the United States Government prohibiting the pollution of lakes, wetlands, streams, or river waters from the dumping of contaminants, refuse, rubbish, or debris.
- F. The Contractor shall submit copies of the SWPPP a minimum of 10 working days prior to beginning construction, to the DPW Director. Contractor shall update the SWPPP as necessary during the work to prevent contamination of the storm water collection system.
- G. Before start of work, Contractor shall train all employees and Subcontractors on the approved SWPPP and related WPCD and provide the Department of Public Works with written documentation of said training.
- H. Suggested SCMs can be obtained from LA DEQ Small Business Assistance Program, 201 Evans Rd. Bldg. 4, Suite 420 Harahan LA. Phone 504-736-7739.

3.03 CONSTRUCTION

- A. The Contractor shall keep a copy of the SWPPP on the job site. The Contractor shall provide continuously at the jobsite all the tools, equipment, and materials necessary to implement the SWPPP at all times from project initiation through completion, including any punchlist or warranty work on the project. At a minimum the following requirements shall be met as applicable, to the maximum extent practicable, at construction sites:
 - 1. Storm Drain System Protection: At the first order of work, the Contractor shall protect the existing storm drain system from entrance of construction debris and pollutants. Such protection shall include implementing the SCMs as outlined in the SWPPP. Protection shall prohibit the discharge of untreated runoff from temporary or permanent street maintenance/landscape maintenance material and waste storage areas from entering the storm drain system. Sediment that is generated on the project site shall be retained using structural drainage controls. In addition, the protection system shall have a minimum of three features:
 - A. A particulate filter of geosynthetic material securely fastened in place such that it cannot be bypassed without significant physical damage;
 - B. A prefilter for the particulate filter; and
 - C. On-hand materials to close off the inlet or opening in the case of a significant pollution spill. Contractor shall monitor and maintain all storm drain inlet protection devices during rain events to prevent flooding.
 - 2. Material Management & Storage: No construction-related materials, wastes, spills or residues shall be discharged from the project site to streets, drainage facilities or adjacent properties by wind or runoff. All materials and/or equipment storage areas where liquid construction materials are placed shall be protected by a physical barrier capable of containing the entire volume of stored liquid materials. During active construction activities, portions of the barrier may be removed for access. However, the barrier materials must be readily accessible for replacement by onsite construction personnel. The barrier must be in place at all times

during the absence of Contractor personnel at the storage site. Building materials shall be placed on pallets and covered in event of rain. Do not store materials in the street or gutter area.

3. Equipment & Vehicle Maintenance: Non-storm water runoff from equipment and vehicle washing and any other activity shall be contained at the project site and shall not be allowed to discharge from the project site to streets, drainage facilities or adjacent properties by wind or runoff. The Contractor shall inspect vehicles and equipment on each day of use. Leaks shall be repaired off-site if possible. If necessary to repair on site, the runoff must be contained, or the problem vehicle or equipment shall be removed from the project site until repaired. If necessary, drip pans shall be placed under the vehicles or equipment while not in use to catch and/or contain drips and leaks.
4. SCMs Inspection: The Contractor shall inspect all pollution control SCMs regularly. The Contractor shall also repair/replace any damaged or clogged element on a daily basis. During periods of precipitation where any runoff occurs, the system shall be checked twice a day, seven days a week, whether or not any work has been performed. The Contractor shall keep a monitoring inspection log of each inspection.
5. Spill Prevention & Cleanup Plan: Contractor shall have a spill prevention plan and spill cleanup materials readily available and addressed in the SWPPP. Spills shall be cleaned up immediately using dry methods if possible. Spill cleanup material shall be properly disposed of offsite. Contractor shall keep a record of any spills in the inspection log. In addition, at the end of the project, the Contractor must certify that all contaminated materials have been properly disposed in accordance with the SWPPP.
6. Asphalt & Concrete Activities: Asphalt and concrete activities shall be scheduled for dry weather. Contractor shall prohibit saw cutting during a storm event of 0.25 inches or greater. Store bags of cement away from gutters and storm drains, sealed and covered, protected from rainfall runoff and wind. Place tarp under cement mixer before operating to catch spills. Never dispose of cement washout or concrete dust onto driveways, streets, gutters or storm drains.
7. Sidewalk Washing: The following methods should be utilized to prevent discharge of sidewalk cleaning wastewater into the storm drain system:
 - A. Sweep and pick up all areas to be cleaned before using water.
 - B. Manually scrape gum from sidewalks and other surfaces.
 - C. Must use high pressure and low volume of water with no additives and at an average usage of 0.006 gallons per square foot of surface area to be rinsed.
 - D. Use a wet/dry vacuum to collect wash water for disposal. Large volumes of wash water may require the use of a small sump pump to remove wash water from the job site.
 - E. One or more of the following methods are recommended to prevent pollutants from entering the storm drain system:
 - 1) Sandbags can be used to create a barrier around storm drains.
 - 2) Rubber mats or plugs can be used to seal drain openings.
 - 3) Temporary berms or containment pads help keep water on site.
 - 4) Use berms of sandbags to direct wash water to landscaping.
 - 5) Use large squeegees to accumulate sheet flow for collection.
 - 6) Remember to remove plugs, berms, and sandbags or you may be liable for possible flooding.
 - F. Wash water that contains hazardous waste such as oil-saturated absorbents, water with lead or other heavy metals from oxidized paint, and solvent cleaners requires special treatment and must be disposed of through a hazardous waste facility.

8. Employee SCMs Training: Contractor shall train employees and Subcontractors on SCMs implementation, general good housekeeping, and proper spill containment and cleanup. Before start of work, Contractor shall provide the Department of Public Works and the Sewerage & Water Board with written documentation of training and keep all documentation in the SWPPP.
9. Inspection: Contractor shall maintain SCMS at all times on a daily basis, shall inspect and repair or replace, as needed, all job site SCMS a minimum frequency (whichever of the following occurs first): biweekly or before, during, and after a major rain event. The contractor shall document the inspections in the SWPPP.
10. Dewatering: Avoid dewatering discharges where possible by using the water for dust control, infiltration, etcetera.

3.04 TEMPORARY EROSION CONTROL

- A. This work consists of constructing and maintaining temporary erosion control features shown on the plans or as directed. Installation of temporary erosion control features shall be coordinated with construction of permanent erosion control features to the extent necessary to ensure economical, effective and continuous control of erosion and water pollution throughout the life of the contract.
- B. The Contractor shall comply with a Storm Water Pollution Prevention Plan (SWPPP) and Storm Water Control Measures (SCMS) approved by the Department when conducting clearing or earthwork operations. The SWPPP shall include the erosion control features as shown on the plans, or as directed, in addition to other required components of the SWPPP specified by the US Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ). The plan shall indicate the use of contract items and the coordination of this work with the scheduling of clearing and earthwork. SCMs include but are not limited to:
 1. All mechanical equipment intended for use at said construction site must be properly maintained,
 2. Erect silt barrier fencing around the construction site,
 3. Cover all drain inlets in the immediate area of the construction site until all work is completed,
 4. Spread and compact all fill material within a short time after delivery (approximately 48 hours),
 5. Drive creosote pilings soon after their delivery (approximately 48 hours),
 6. Cover any loose piles of dirt or creosote pilings with plastic, if they will not be put into place in a short time,
 7. Clean all mortar and cement mixing equipment in such a manner that the discharge does not enter the storm water system, but is removed as solid waste to a proper location,
 8. Cover all piles of sand used for mortar with plastic,
 9. Do not store fuel, automotive fluids, paint, glue, solvents, plaster, or other petroleum products on site for extended periods of time, or in areas where they are subject to spillage or open to the elements. Such products should remain in their original packaging until ready for use,
 10. Maintain proper absorbent and dirking material to guard against accidental spillage of automotive fluids and other liquid products used on site,
 11. Seed grass mulch and fertilize (taking care not to over-fertilize) the soil areas of the construction site after all work is completed,
 12. Have all workers and equipment enter the construction area from a single stable entrance,

13. Have all work coordinated by a single Contractor who is responsible for the SWPPP.

C. Control of Erodible Soil:

1. General: The Contractor shall prevent the transmission of soil particles into streams, canals, lakes, reservoirs or other waterways. Except as necessary for construction, excavated material shall not be deposited into streams or impoundments, or in a position close enough to be washed in waterways by high water or runoff. The Contractor shall not disturb lands or waters outside the limits of construction, except as authorized.
2. Adjacent to Waterways: Stream banks shall be kept in their natural state. The Contractor shall not unnecessarily strip protective vegetation in the vicinity of stream banks and shall conduct operations without damage to banks. Banks shall not be excavated except as shown on the plans or as otherwise approved in writing. Work roads requiring bank cuts shall be approved by the DPW Director prior to making such cuts. The banks shall be restored by the Contractor to the satisfaction of the project DPW Director.
3. Adjacent to Property: The location of, and method of operation in, borrow pits, material pits and disposal areas obtained by the Contractor for waste material from the project (other than commercially operated sources) shall be the Contractor's responsibility.

D. Materials: Materials not covered by project specifications shall meet commercial grade standards and shall be approved before being incorporated into the project. No testing of materials used in temporary erosion control features will be required. Acceptance of temporary erosion control materials will be by visual inspection.

1. Mulches: Mulch shall comply with LaDOTD Subsection 1018.19 and emulsified asphalt shall conform to LaDOTD Section 1002. Use of cypress mulch is discouraged.
 2. Seeding: Grass shall be an approved quick-growing species suitable to the area, providing a temporary cover which will not compete with permanent grasses. Rye grass is the only acceptable grass for winter cover.
 3. Slope Drains: Slope drains may be constructed of pipe, fiber mats, rubble, Portland cement concrete, asphaltic concrete, plastic sheets or other acceptable material.
 4. Fertilizer: Fertilizer shall comply with LaDOTD Subsection 1018.16.
 5. Silt Fencing: Silt fencing shall be wire-supported or self-supported systems. Other silt fencing systems may be used when approved.
- A. Wire-Supported: Wire-supported silt fencing shall consist of standard woven livestock wire, and minimum of 14-gage (2.0 mm diameter) wire, a minimum of 36 inches (900 mm) in height with a maximum wire spacing of 6 inches (150 mm). Posts shall be either wood or steel installed a minimum of 2 feet (0.6 m) in the ground. Filter material shall be burlap weighing approximately 7 1/2 ounces per square yard (0.25 kg per sq. m), approved jute fabric or approved geotextile fabric. Geotextile fabric shall comply with Section 1019, Class F.
- B. Self-supported silt fencing shall consist of an approved geotextile fabric suitably attached to posts of either wood or steel installed in accordance with plan details. Geotextile fabric shall comply with LaDOTD Section 1019, Class G.
6. Lime: Agricultural lime shall comply with LaDOTD Subsection 1018.17.
 7. Temporary Construction Entrance: Temporary construction entrances shall consist of stone or recycled Portland cement concrete complying with LaDOTD Subsection 711.02, 2 lb (1 kg) class placed on geotextile fabric complying with Section 1019, Class D. The geotextile fabric underliner shall be placed at the locations designated for temporary construction entrances before stone or recycled Portland cement concrete is placed. The stone or recycled Portland cement concrete shall be placed and compacted to the required thickness as directed. This

work also includes additional measures required to remove mud from truck tires, such as wash racks, etc.

8. Hay Bales: Hay or straw bales shall be rectangular bales, acceptable to the DPW Director. The average length of bales shall be 34 inches (850 mm) minimum.
- E. Exposure of Erodible Earth: The DPW Director may direct the Contractor to provide immediate permanent or temporary erosion or pollution control measures to prevent contamination of streams, lakes, tidal waters, reservoirs, canals or other impoundments or prevent detrimental effects on property outside the right-of-way and damage to the project. Limitations of areas in which excavation and embankment operations are underway shall be commensurate with the Contractor's capability and progress in keeping finish grading, temporary erosion control, and permanent erosion control measures in accordance with the accepted schedule.
- F. Incorporation of Erosion Control features: Use of temporary erosion control features will be authorized to correct unforeseen conditions that develop during construction; to control erosion prior to the time it is practical to construct permanent control features; or to provide immediate temporary control of erosion that develops during normal construction operations but is not associated with permanent erosion control features. Permanent erosion control features shall be incorporated into the project at the earliest practical time. Temporary erosion control features will be used as directed in areas where stage construction or other conditions not under control of the Contractor preclude completion of a section of roadway in a continuous manner, or where subsequent construction operations will cause damage to permanent erosion control features.
- G. Construction Requirements: Temporary erosion control features shall consist of, but not be limited to, temporary seeding, temporary mulching, sandbagging, slope drains, sediment basins, sediment check dams, erosion checks, artificial coverings, berms, and stone entrances. The DPW Director may direct use of temporary erosion control features or methods other than those included in the original contract. Soil deposits outside the right-of-way shall be immediately removed and the surface repaired at no direct pay. The DPW Director shall have the authority to require the Contractor's operations to be discontinued until erosion deposits have been cleared and the area restored.
 1. Temporary Seeding: Seeding shall be done in accordance with LaDOTD Section 717, except that ground preparation will be limited to blading the area. Lime or fertilizer shall be applied in accordance with LaDOTD Section 718; however, lime or fertilizer may be omitted or the application rate reduced as directed.
 2. Temporary Mulching: Mulch and emulsified asphalt shall be furnished and applied in accordance with LaDOTD Section 716. Mulch may be omitted or the application rate reduced as ordered. When permanent seeding operations begin, temporary mulch materials may be plowed under during ground preparation.
 3. Sandbagging: Sandbags shall be placed as directed.
 4. Baled Straw or Hay: Baled straw or hay shall be placed as directed to form checks or dams to control erosion and siltation. Bales shall be properly staked or otherwise secured as directed, as shown on the plans. The bales shall be buried as necessary to prevent scour under the bales. A minimum of 2 stakes shall be driven through each bale.
 5. Filter Socks: Filter socks may be used in lieu of baled straw or hay in front of catch basins.
 6. Geotextile Filters: Use geotextile filters in combination with filter socks at catch basins in lieu of baled straw or hay.
 7. Slope Drains: Slope drains shall be constructed with acceptable materials in accordance with plan details or as directed, if necessary to prevent scour. The discharge area shall be

- stabilized or protected by temporary riprap as directed. Cost of discharge area protection will be included under the slope drain item.
8. Sediment Basins: Sediment basins shall be constructed in accordance with plan details or as directed.
 9. Sediment Check Dams: Check dams shall be constructed at locations shown on the plans or as directed. Check dams shall be constructed before clearing and grubbing or grading in the area is begun unless otherwise directed.
 10. Silt Fencing: Silt fencing shall be furnished and constructed at designated locations or other locations, as directed by the DPW Director.
 11. Berms: Earth berms shall be constructed as directed to divert the flow of water from erodible surfaces.
 12. Unforeseen Conditions: When unforeseen conditions are encountered, the DPW Director may direct the Contractor to construct such temporary devices as required to control erosion during construction. Details may be developed jointly by the DPW Director and the Contractor.
 13. Maintenance of Erosion Control Features: The Contractor shall install, construct, repair, and maintain temporary erosion control features within 7 calendar days of being instructed to do so by the DPW Director. Temporary erosion control features shall be inspected at least once every 14 calendar days and within 24 hours after a rainfall event of 0.5 inches or greater. The features are to be maintained as described below and, if required, replaced as directed at no direct pay.
 - A. Temporary Seeding: The seeded areas showing erosion after inspection shall be reseeded if necessary.
 - B. Mulches: Mulched areas showing erosion shall be repaired and the mulch reapplied if necessary.
 - C. Straw or Hay Bale Barriers: The bale barriers shall be inspected after each rainfall and time frame as defined above and at least daily during prolonged rainfall. Close attention shall be paid to the repair of damaged bales, "end runs" and undercutting beneath bales.
 - D. Filter Socks and Geotextile Fabric: Ensure that filter socks remain in place and that geotextile filters do not allow runoff to enter the catch basin around the edges.
 - E. Slope Drains: Slope drains shall be inspected weekly and after each rainfall as defined above, and repairs made if necessary. The Contractor shall avoid the placement of any material on and prevent construction traffic across the slope drain.
 - F. Sediment Check Dams: Sediment deposits shall be removed when the deposits reach one-half the height of the check dam. Inspections shall be made to ensure that the center of the dam is lower than the edges. Erosion around the edges shall be corrected immediately.
 - G. Silt Fencing: Sediment deposits shall be removed when the deposits reach one-half the height of the fence. If the fabric on the silt fence decomposes or becomes ineffective, the fabric shall be replaced promptly.
 - H. Temporary Stone Construction Entrance and/or Wash Racks: The construction entrance shall be maintained to allow for removal of mud from the tires. The sediment from the wash rack runoff shall be removed once the wash rack is no longer performing as intended.
 14. Removal of Temporary Erosion Control Features: Temporary erosion control feature existing at the time of construction of permanent erosion control features shall be removed or incorporated into the soil in such manner that no detrimental effect will result. The DPW Director may direct that temporary features be left in place. Sediment in sediment basins, silt fences, check dams, and other catchment areas shall be removed, replaced with acceptable soils in accordance with LaDOTD Subsection 203.06, and compacted as directed at no direct pay.

3.05 PROTECTION DURING SUSPENSION OF OPERATIONS

- A. Prior to the suspension of operations, the Contractor shall shape the top of the earthwork in such manner as to permit runoff of rainwater and shall construct earth berms along the top edges of embankments to intercept runoff water. Temporary slope drains shall be provided in the earth berm to carry runoff. When such preventive measures fail, the Contractor shall immediately take other action as necessary to prevent erosion and siltation. The DPW Director may direct the Contractor to perform other erosion control work during suspensions of contract time.

3.06 MEASUREMENT

- A. When temporary erosion and pollution control measures are required due to the Contractor's negligence or failure to install permanent controls, such work shall be performed by the Contractor at no direct pay. Required temporary erosion and pollution control work which is not due to the Contractor's negligence will be measured as follows:
 - 1. When separate items for temporary erosion control devices are included in the contract, and the work is ordered, the quantities to be paid for will be the weight in pounds (kg) of Temporary Seeding and in tons (Mg) of Temporary Mulching; the volume in cubic yards (cu m) of Sandbagging with the measurement of sand being made in a batch box or other satisfactory means; the number of hay bales placed; the length in feet (m) of Temporary Slope Drains measured along the ground surface and Silt Fencing measured along ground surface between end posts; the number of Sediment Basins and Sediment Check Dams acceptably constructed; the number of gallons (L) of emulsified asphalt, and the number of construction entrances.
 - 2. Temporary erosion control items may be eliminated when conditions do not justify their use.
 - 3. When temporary erosion control work is ordered and is not covered by contract items, the work shall be performed as extra work in accordance with LaDOTD Subsection 109.04 except that no extra work order will be required prior to starting work.
 - 4. The construction of temporary earth berms along edges of the roadway to prevent erosion during grading and subsequent operations will not be measured for payment.
- B. In case of failure of the Contractor to control erosion, or siltation, the DPW Director may employ outside assistance or use his own forces to provide the necessary corrective measures, and the cost thereof will be deducted from payments for the work. Partial payments will be withheld until satisfactory temporary erosion control is established.

3.07 PAYMENT

- A. No separate measurement or payment will be made for services or products related to all environmental protection and stormwater pollution prevention. All costs in connection to this section shall be included in the contract prices for the items of work to which the work is incidental.

END OF SECTION

SECTION 31 37 00 00
RIPRAP

PART 1 GENERAL

1.01 Description of Work

- A. This specification covers the furnishing and installation of riprap. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Demolition and removal of materials shall be as required to support the work.

1.02 PRODUCTS

- A. Riprap: Stone used for dumped riprap shall be hard, durable, angular in shape, resistant to weathering and to water action, and free from overburden, spoil, shale, and organic material. Neither width nor thickness of a single stone should be less than one third its length. Rounded stone, boulders, shale, and stone with shale seams will not be acceptable. The minimum density of the riprap material shall be 162 pounds per cubic foot. Each load of riprap shall be reasonably well graded. Sand and rock dust exceeding 5 percent by weight of each load shall not be permitted.
- B. Riprap Bedding: The riprap bedding blanket shall consist of well graded gravel, crushed rock, sand, or a combination thereof with a maximum size of 6 inches. All material comprising the riprap bedding blanket shall be composed of tough, durable particles, reasonably free from thin, flat, and elongated pieces, and shall contain no organic matter nor soft, friable particles in excess quantities.

1.03 EXECUTION

- A. Preparation
 - 1. Prepare earth slopes by grading and compacting.
- B. Installation:
 - 1. Riprap Bedding Blanket Layers shall be placed on the prepared slope or area to develop the full thickness. Each layer shall be placed in one operation, using methods that will not cause segregation of particle sizes within the bedding. The surface of the finished layer should be reasonably even and free from mounds or windows.
 - 2. Stone for Riprap shall be placed on the prepared slope or area in a manner that will product a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be placed to its full course in one operation and in such a manner as to avoid displacing the underlying material. The larger stones shall be well distributed and the entire mass of stone shall be well-graded. The result shall be a compact, uniform riprap layer.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes Concrete Paving Including the Following:
 - 1. Driveways.
 - 2. Roadways.
 - 3. Parking lots.
 - 4. Curbs and gutters.
 - 5. Walks.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.
- C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
 - 1. Exposed Aggregate: 1-lb Sample of each mix.
- D. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.

7. Bonding agent or epoxy adhesive.
 8. Joint fillers.
- B. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. 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 of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
 2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 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.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.08 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.02 CONCRETE CURB AND GUTTER

- A. Integral concrete curb shall be either mountable or barrier curb. Concrete curb and barrier curb shall be constructed monolithically with the same materials, having the same compressive strength and placed and cured in the same manner as the concrete in the roadway slab. The dimensions shall be as shown on standard plans. The overall depth shall be determined by the curb exposure, depth of gutter bottom and roadway slab.
- B. The curb forms shall provide for the dimensions specified and must be set to the established grades.
- C. Premoulded joint filler shall be placed and extended through the entire curb section, at those points where joint filler is used in the roadway slab.
- D. Undowelled contraction joints shall be placed through the entire width of the concrete curb or curb and gutter bottom, at no greater than fifteen (15') foot intervals. Contraction joints shall be formed by a jointing tool or other acceptable means, having a 2" depth and 1/4" width and filled with silicone sealant or an approved joint sealant.
- E. Where the concrete gutter is constructed as a part of combined curb and gutter bottom, it shall conform to the requirements of combined curb and gutter bottom.
- F. The subgrade shall meet the requirements for roadway pavement sub-grade.
- G. Immediately after the concrete has been placed, it shall be tamped, struck off and worked with a wood float in a manner to provide a surface free from irregularities and depressions, bringing the mortar to the top. The surface shall then be broomed or brushed with a soft hand broom in the direction of the flow line of the gutter. Surface joints shall be made by a steel joining tool and pre-moulded joint filler shall be placed and extended through the entire gutter section at those joints where filler is used in the roadway slab or curb.
- H. Where indicated, curb gap inlet are to be provided on curbs adjacent to stormwater management facilities.
 - 1. Provide curb gaps as indicated at maximum spacing of fifteen (15) feet on center
 - 2. Provide Energy dissipation material at all inlet locations, refer to Section 33 4231 "Storm-water Area Drains and Inlets".

2.03 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.04 STEEL REINFORCEMENT

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from galvanized-steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.
- E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.
- H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.
- I. Plain-Steel Wire: ASTM A 1064/A 1064M, galvanized.
- J. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, plain.
- L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.
- M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.
- N. Tie Bars: ASTM A 615/A 615M, Grade 60; deformed.
- O. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

- Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
- R. Zinc Repair Material: ASTM A 780/A 780M.

2.05 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150/C 150M, gray or white portland cement Type I, Type II, or Type III.
 - 2. Fly Ash: ASTM C 618, Class C or Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - 1. Aggregate Sizes: 3/4 to 1 inch nominal.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Color: As indicated by manufacturer's designation.
- H. Water: Potable and complying with ASTM C 94/C 94M.

2.06 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

- B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

2.07 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.08 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
- F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
- G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.09 STAMPED DETECTABLE WARNING MATERIALS

- A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - 1. Size of Stamp: One piece, per New Orleans DPW standards.

- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Slag Cement: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
 - 2. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
 - 3. Air Content: 5 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range, water-reducing 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.
- F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- H. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum W/C Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
 - 4. Solar Reflectance Index: Not less than 29.

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earthwork."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to center-line unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
- A. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- A. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.07 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch-deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
 - 1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - 3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
 - 1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - 2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.

3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
 3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.
- D. Rock-Salt Finish: After initial floating, troweling, or brooming, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.
1. Embed rock salt into plastic concrete with roller or magnesium float.
 2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
 3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.
- E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:
1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
 2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
 3. After final power floating, apply a hand-troweled finish followed by a broom finish.
 4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.09 DETECTABLE WARNING INSTALLATION

- A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."
1. Tolerance for Opening Size: Plus 1/4 inch.
- B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be

installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

- C. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.
 - 1. Before using stamp mats, verify that the vent holes are unobstructed.
 - 2. Apply liquid release agent to the concrete surface and the stamp mat.
 - 3. Stamping: While initially finished concrete is plastic accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
 - 4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
 - 5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less 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-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.11 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
 - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 6. Vertical Alignment of Dowels: 1/4 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 8. Joint Spacing: 3 inches.
 - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 10. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
- A. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
- A. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture

proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 15
GRANULAR MATERIAL

PART 1 GENERAL

1.01 SUMMARY

- A. Related Documents:
 - 1. Drawings and general provisions of the Subcontract apply to this Section.
 - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

1.02 DESCRIPTION

- A. This work consists of subgrade drainage courses, and furnishing and placing batture sand for dressing behind the curb and granular material for other adjustments, in accordance with these Specifications and in conformity with the lines, grades and typical sections shown on the plans and as directed.

1.03 SECTION INCLUDES

- A. Aggregates and sand materials utilized for base courses, subbase materials, choking course, energy dissipation material, and pipe outlet aprons.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Site Storage: Store aggregate material(s) at/in an on-site covered location or one where material will not be contaminated or impacted by siltation.

1.05 SITE CONDITONS

- A. Unfavorable Weather: When weather is such that satisfactory results cannot be secured, suspend operations until the weather is considered favorable.
- B. Wet Subgrades: Do not place material on wet or muddy subgrade.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate materials:
 - 1. Where specified material shall comply with ASTM No.57 specifications
 - 2. Where specified material shall comply with ASTM No.2 specifications
 - 3. Where specified material shall comply with ASTM No.8 or 9 specifications
- B. Water: fresh, clean, potable

2.02 AGGREGATE MATERIAL GRADATIONS

- A. Crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131
- B. All stone materials shall be washed with less than 2% passing the No. 200 sieve.
- C. Joint/opening filler, bedding, base and subbase: conforming to ASTM D448 gradation

Table 1: ASTM No. 8 Grading Requirements Bedding and Joint/Opening Filler

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.16 mm (No. 16)	0 to 5

Table 2: ASTM No. 9 Grading Requirements Bedding and Joint/Opening Filler

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	100
4.75 mm (No. 4)	85 to 100
2.36 mm (No. 8)	10 to 40
1.16 mm (No. 16)	0 to 10

Table 3: ASTM No. 57 Base Grading Requirements

Sieve Size	Percent Passing
37.5 mm (1 1/2 in.)	100
25 mm (1 in.)	95 to 100
12.5 mm (1/2 in.)	25 to 60
4.75 mm (No. 4)	0 to 10
2.36 mm (No. 8)	0 to 5

Table 4: Grading Requirement for ASTM No. 2 Subbase

Sieve Size	Percent Passing
75 mm (3 in.)	100
63 mm (2 1/2 in.)	90 to 100
50 mm (2 in.)	35 to 70
37.5 mm (1 1/2 in.)	0 to 15
19 mm (3/4 in.)	0 to 5

D.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of General Conditions: Examine site and verify that conditions are suitable to receive Work and that no defects or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.
- B. Subgrade: Review to verify that it has been inspected, graded to the correct grades, and compacted as required for correct installation of aggregate base.
- C. Notification of Unsuitable Conditions: Before proceeding with Work, notify the Project Manager in writing of unsuitable conditions and conflicts.

3.02 PREPARATION

A. Protection of Existing Conditions:

1. Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, plant materials and walks on or adjacent to the site of the Work.
2. Provide barricades, fences or other barriers to protect existing conditions to remain from damage during construction.
3. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
4. Submit written notification of damaged plants and structures to the Project Manager.

B. Subgrade Preparation:

1. Meet requirements of Project Geotechnical Report recommendations for subgrade preparation prior to placement of aggregate base or cement-treated base.
2. Grade subgrade with uniform slope between points where elevations are given.
3. Use equipment of proper size and appropriate type to achieve grades required.
4. Grade subgrade surface to within 0.05-foot (15 mm) of elevations indicated by the Drawing details.
5. Fill and compact any depressions and remove loose material to finish true to line and grade, presenting a smooth, compacted and unyielding surface, except where indicated otherwise.
6. Remove debris, loose dirt and other extraneous materials.

3.03 AGGREGATE BASES

A. Hauling:

1. Use of dragline equipment to transport aggregate from stockpiles to elevators or other loading devices will not be permitted.
2. Distribute hauling over the area to be paved in such a manner as to be most effective in the compacting of the surfacing.
3. Hauling over any of the surfacing in process of construction will not be permitted when, in the opinion of the University, the effect will be detrimental.
4. Uniformly load hauling vehicles when it is practicable.

B. Placement of Aggregate Base:

1. Spread base in an even distribution of material without perceptible segregation.
2. Method of spreading and field operation shall be in accordance with of LADOTD Specifications.
3. Construct base course in lifts not exceeding 6 inches (150 mm) in depth so that when compacted to the specified density, the finished surface will conform to grades and dimensions shown, with proper allowance for subsequent courses where specified.
4. Construct the base course in an orderly manner so that reasonable size areas will be ready for testing.
5. Equipment such as scrapers, and other equipment essentially used for earth excavation, will not be permitted.
6. Compaction equipment shall be adequate in design and number to obtain the specified density for each layer while still moist.
7. Apply water as needed to obtain the specific densities
8. Place each layer of base course and compact to the specified density before a succeeding layer is placed.

C. Compacting of Aggregate Base:

1. Compact each lift of base as soon after spreading operations as practicable and continue until a density of 95 percent of the maximum density has been achieved as determined in accordance with ASTM D1557.
2. Roll each course of surfacing until the material does not creep under the roller before a succeeding course of surfacing material is applied.
3. At the outer edges of the surfacing and continue toward the center.

D. Correction of Surface Defects: Should irregularities develop in any surface during or after rolling, they shall be remedied by loosening the surface and correcting the defects, after which the entire area, including surrounding surfaces, shall be rerolled until thoroughly compacted. Finished surfaces shall be true to grade and crown before proceeding with surfacing.

E. Final Clean-up:

1. After work is completed, the entire area shall be neatly finished and trimmed to lines, grades and cross sections shown.
2. Unused construction material shall be removed, and stockpile areas shall be cleaned of aggregate and left in an acceptable condition.

3.04 TOLERANCES

A. Subgrade Surface: Plus or minus 0.05-foot (15 mm) or elevations indicated by the Drawing details.

B. Aggregate Base Course Variation from Thickness: Plus or minus 0.05-foot (15 mm).

C. Aggregate Base Course Finished Surface Smoothness: Plus or minus 1/4-inch (6 mm).

3.05 MEASUREMENT

A. Soil dressing behind the curb, aggregates, and granular material shall be measured by the cubic yard, truck measure.

3.06 PAYMENT

A. No separate measurement or payment will be made for services or products related to all granular material. All costs in connection to this section shall be included in the contract prices for the items of work to which the work is incidental.

END OF SECTION

SECTION 32 18 16.13

PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Unitary, seamless surfacing.

1.3 DEFINITIONS

- A. Definitions in ASTM F2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. SBR: Styrene-butadiene rubber.
- D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of protective surfacing.
 - 1. Include plans, sections, placement and penetration details, and attachment to substrates.
 - 2. Include accessories and edge terminations.
- C. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of protective surfacing and exposed finish.
 - 1. Include Samples of accessories to verify color and finish selection.
 - 2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches (150 by 150 mm).

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of unitary surfacing product.
- C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

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

1.8 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation as measured by reduction of critical fall height.
 - b. Deterioration of protective surfacing and other materials beyond normal weathering.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.

1. No Fault Safety Surface as manufactured and sold by No Fault Sport Group, LLC, or approved equal. Consists of synthetic poured-in-place safety surfacing meeting the requirements of this specification and comprised of SBR, TPV and polyurethane binder. Manufactured and installed by No Fault Sport Group, LLC (866-637-7678; www.nofault.com) and its certified installation crews.
- B. Polyurethane Binder:
1. Polyurethane Binder for safety surfacing shall be specifically designed for use with rubber granule material for outdoor installations.
 2. No toluene diphenyl isocyanate (TDI) shall be used.
 3. No filler materials shall be used in urethane such as plasticizers and the catalyzing agent shall contain no heavy metals.
 4. Weight of polyurethane shall be no less than 8.5 lbs/gal (1.02 Kg/l) and no more than 9.5 lbs/gal (1.14 Kg/l).
 5. COLOR TINTED BINDER WILL NOT BE ALLOWED.
 6. Aromatic or aliphatic Polyurethane Binder may be used.
- C. SBR (Impact Layer):
1. Only 100% shredded styrene butadiene rubber may be used.
 2. Strands of SBR may vary from 0.5 mm – 2.0 mm in thickness by 3.0 mm – 20 mm in length.
- D. TPV (Wear Surface):
1. TPV material shall be angular granules with a Shore A Hardness of 65A $\pm$ 5, a Tensile Strength equal to or greater than 3.0 Mpa, and an Elongation at Break greater than 400%.
 2. Size of TPV particles shall not be less than 1.00 mm, or greater than 4.0 mm across.
 3. STRAND, SHAVED, CHIPPED OR SHREDDED MATERIAL OF ANY TYPE IS NOT ACCEPTABLE.
 4. Critical Height: 7 feet at exit of slide.
 5. Overall Thickness: Not less than as required for critical height indicated.
 6. Wearing Surface Color: To contain 20% black and 80% color as selected by Architect from manufacturer's full range.
- E. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.

1. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.
- C. Coordinate work with installation of Owner provided boat.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.
- B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
 1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
 2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.
 3. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.

3.3 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
 4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
 6. Edge Treatment: Extended surface course as indicated on Drawings.

3.4 PROTECTION

- A. Prevent traffic over seamless surfacing for not less than 72 hours after installation, or as directed by manufacturer.

END OF SECTION 32 18 16.13

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Chain-link animal caging panels.
 - 2. Swing gates.
 - 3. Chain link animal dig barriers.
- B. Related Requirements:
 - 1. Division 01 Section "Animal Management Requirements of Construction".
 - 2. Division 05 Section "Animal Caging Rigid Panel Systems".

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 construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For each type of chain link fabric, 12" x 12" sample.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to set quality standards for fabrication and installation.
 - 1. Build mockups for the following chain link enclosures and gates, including accessories.
 - a. Komodo Dig Barrier: ~100 sf showing connections to shotcrete and CIP concrete.
 - b. Komodo vestibule roof: One panel.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

- A. Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 - 2. Warranty Period: One (1) year from date of Final Inspection for Owner Occupancy.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric panel size: As indicated on Drawings.
 - 2. Steel Wire for Fabric: 9 gauge.
 - a. Mesh Size: 2" x 2".
 - b. Zinc-Coated Fabric: ASTM A392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
 - c. Polymer-Coated Fabric: ASTM F668, Class 2b over zinc-coated steel wire.
 - 1) Color: As selected by Architect from manufacturer's full range, according to ASTM F934.
 - d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Knuckled at both selvages.

2.2 CHAIN LINK FRAMEWORK

- A. Support framework as indicated on caging and structural drawings.
 - 1. Chain link Panel Size: As indicated on drawings.
 - 2. Horizontal and Vertical Framework Members: As indicated on drawings.
 - 3. Hot Dipped Galvanized.

2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.177-inch diameter, tension wire according to ASTM F1664, Class 2b over zinc-coated steel wire.
 - 1. Color: As selected by Architect from manufacturer's full range, according to ASTM F934.

2.4 SWING GATES

- A. General: ASTM F900 for gate posts, single and double swing gate types.
 - 1. Gate Leaf Width: As indicated on drawings.
 - 2. Framework Member Sizes and Strength: As indicated on drawings.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
 - 2. Gate Posts: As indicated on drawings.
 - 3. Gate Frames and Bracing: As indicated on drawings.
- C. Frame Corner Construction: Welded.
- D. Hardware:
 - 1. As indicated on drawings.

2.5 FITTINGS

- A. Provide fittings according to ASTM F626.
- B. Post Caps: Provide for each post.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: As indicated on drawings.
- E. Tension and Brace Bands: Material matching fence system.
- F. Tension Bars: Length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment. Material matching fence system.

- H. Tie Wires, Clips, and Fasteners: According to ASTM F626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- I. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Polymer coating over metallic coating.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. 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. 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 applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly as indicated on drawings.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
- G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - 1. As indicated on Drawings.
- H. Top Rail: Install as shown on drawings.
- I. Chain-Link Fabric: Apply fabric as shown in drawings. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.3 GATE INSTALLATION

- A. Install gates level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.4 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 13

SECTION 32 31 29

FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Aldabra Exhibit Fence & Gates
 - 2. Aldabra Rub Rail
 - 3. Guest Viewrail & Gates.
 - 4. Stockade Fence & Gates.
 - 5. Exclusion Gates.
- B. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete."
 - 2. Division 05 Section "Pipe and Tube Railings".
 - 3. Division 05 Section "Animal Caging Rigid Panel Systems".
 - 4. Division 09 Section "High Performance Coatings".
 - 5. Division 32 Section "Chain Link Fences and Gates."

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site or Construction Trailer.

1.4 DEFINITIONS

- A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pink Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
- B. Shop Drawings: For all fencing, gates and rails. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples:
 1. Provide Samples 12 inches in length for linear materials listed below.
 2. Provide Samples 12 inches square for mesh products listed below.
 3. Aldabra Rub Rail polypropylene panel.
 4. Stockade Fence Cedar Boards.
 5. Exclusion Fence Mesh.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Include 6' minimum length of fence/rail complying with requirements.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 3. Subject to Owner's Representative/Architect's approval, fence mockups may be constructed at the proposed final location.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation and stacks and under coverings.
- B. Handle and store composite lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

FENCES AND GATES

2.1 ALDABRA EXHIBIT FENCE & GATES

- A. Posts: Galv Steel in sizes indicated on drawings.
- B. Rails: Galv Steel in sizes indicated on drawings.
- C. Finish: Galv, prime and painted.
- D. Fasteners: G90 galvanized bolts.
- E. Hardware:
 - 1. Hinges: Heavy Duty Steel Barrel Hinge by www.hardwaresource.com, SKU #782000, or approved equal.
 - 2. Drop Latch: Heavy-duty, H.D. Galvanized pad-lockable drop latch.
 - 3. Slide Bolt: Stainless Steel pad-lockable slide bolt. Surface mounted with bolts. SKU #504600 from www.hardwaresource.com.
 - 4. Cane Bolt: 1/2" diameter x 18" long galvanized cane bolt. SKU #215332 from www.hardwaresource.com.

2.2 ALDABRA RUB RAIL

- A. Posts: Galvanized Steel angles in sizes indicated on drawings.
- B. Rails: Galvanized Steel plate in sizes indicated on drawings.
- C. Finish: Galvanized Steel.
- D. Polypropylene panel: Natural color is sizes indicated on drawings.
- E. Fasteners: Galvanized bolts in locations indicated on drawings.

2.3 GUEST VIEWRAIL & GATES

- A. Guest Viewrail & Gate System: Basis of Design for all pieces shown on drawings is from Orleans Ornamental Iron & Casting Distributors, Inc. 504-947-4363. Or approved equal. www.orleansornamental.com.
- B. Finish: Galvanized, primed and painted.

2.4 ZOO PERIMETER GATE

- A. Gate System: Delegated design for Orleans Ornamental Iron & Casting Distributors, Inc. 504-947-4363. www.orleansornamental.com. Or approved equal.
- B. Finish: Galvanized, primed and painted.

2.5 EXCLUSION GATES

FENCES AND GATES

- A. Mesh: Basis of design for quality available from www.wireclothman.com, or approved equal.
 - 1. Finish: Galvanized and PVC – coated.
 - 2. Wire Spacing: As indicated on drawings.
 - 3. Wire Gauge: As indicated on drawings.
- B. Posts:
 - 1. End Posts & Tension Posts: HF40, galvanized steel posts in sizes and finishes indicated on drawings. Finish as indicated on drawings.
- C. Tension Bar: 5/8" wide, vinyl coated.
- D. Gate Hardware:
 - 1. Hinges: Basis of design for quality is 3" round x 2" square 180° malleable steel hinge from www.hooverfence.com, or approved equal.
 - 2. Latch: Basis of design for quality is square fork and collar latch, galvanized from www.hooverfence.com, or approved equal.
 - 3. Cane Bolt: For double leaf gates, 1/2" diameter x 18" long, galvanized cane bolt. SKU 215332 from www.hardwaresource.com, or approved equal.

2.6 STOCKADE FENCES AND GATES

- A. Posts: Steel in sizes indicated on drawings. H.D. Galvanized.
- B. Gate Frames: Steel in sizes shown on drawings. H.D. Galvanized.
- C. Finish: As indicated on drawings.
- D. Wood Boards and Dimensional Lumber: Sizes as indicated on drawings. Cedar to be Grade D or better clear. Finish as indicated in drawings.
- E. Fasteners: Stainless steel screws and galvanized bolts in locations indicated on drawings.
- F. Hardware:
 - 1. Hinges for Gate Leafs less than 6' wide: Heavy Duty Steel Barrel Hinge by www.hardwaresource.com, SKU #782000, or approved equal.
 - 2. Hinges for Gate Leafs greater than 6' wide: Heavy Duty Steel Barrel Hinge by www.hardwaresource.com, SKU #782002, or approved equal.
 - 3. Drop Latch: Heavy-duty, H.D. Galvanized pad-lockable drop latch.
 - 4. Slide Bolt: Stainless Steel pad-lockable slide bolt. Surface mounted with bolts. SKU #504600 from www.hardwaresource.com.
 - 5. Cane Bolt: 1/2" diameter x 18" long galvanized cane bolt. SKU #215332 from www.hardwaresource.com.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 10 feet or line of sight between stakes. Indicated locations of utilities, underground structures, benchmarks, and property monuments.
 - 1. Construction layout and field engineering are specified in Division 01 Section "Execution."
- B. Clean substrates of projections and substances detrimental to application.

3.3 FENCE AND RAIL INSTALLATION

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Install fences according to manufacturer's written instructions, if applicable.
- C. Install fences by setting posts as indicated and fastening rails and infill panels to posts.
- D. 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 members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Apply copper naphthenate field treatment to comply with AWP A M4, to cut surface of preservative-treated lumber.
- F. Sleeve-it Post Anchors: Install per manufacturer's recommendations. Do not exceed post spacing for design loads. Coordinate with adjacent segmental retaining wall design & installation.
- G. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed, or compacted per specifications, soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet, unless otherwise detailed.

- H. Post Setting: Set posts as shown on plans, in concrete or by mechanically driving into soil at indicated spacing.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect above ground portion of posts for concrete splatter.
 - a. Exposed Concrete: Edge of footing to be flush with grade, unless otherwise detailed. Extend center 2 inches above grade. Finish and slope top surface to drain water away from post.
 - 3. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 4. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 - 5. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts, unless otherwise detailed.
 - a. Extend posts at least 5 inches into sleeve, unless otherwise detailed.
 - b. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
 - 6. Mechanically Driven Posts: Drive into soil to depth of 30 inches unless otherwise detailed. Protect post top to prevent distortion.
 - 7. Space posts uniformly to dimensions shown on details.
- I. For exposed work, arrange fasteners in straight row parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
- J. Mesh Panel cables and infill mesh to be installed taught without sag.

3.4 GATE INSTALLATION

- A. Install gates level, plumb, and secure for full opening without interference. Attach hardware according to manufacturer's written instructions using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- B. Hardware: Coordinate all lockable hardware with the Owner's Mastery Key system. Padlock's provided by Owner.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, wrap, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout

entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

- B. Lubricate hardware and other moving parts.

END OF SECTION 323129

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Controllers.
12. Boxes for automatic control valves.

B. Related Sections:

1. Division 32 Section "Planting Soils and Animal Substrates."

1.2 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. ET Controllers: Evapo Transpiration Controllers. Irrigation controllers which use some method of weather based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET; broadcasting of ET measurements; or use of on-site sensors to track ET.
- D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 PERFORMANCE REQUIREMENTS

- A. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- B. Location of Sprinklers and Specialties: Design location is approximate. Maintain 100 percent irrigation coverage of areas indicated.
- C. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 1. Refer to Division 00 "Geotechnical Data" and Division 32 "Planting Soils and Animal Substrates" for existing and proposed soil mixes.
- D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
 - 1. Irrigation Main Piping: 200 psig.
 - 2. Circuit Piping: 150 psig.
- E. Manufacturer: Basis of Design for quality product for system is Rain Bird components, or approved equal.

1.4 ACTION SUBMITTALS

- A. Materials List – Submit three copies of a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Wiring Diagrams: For power, signal, and control wiring.
- D. Delegated-Design Submittal: For irrigation 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- B. Qualification Data: For qualified Installer.
- C. Zoning Chart: Show each irrigation zone and its control valve.

- D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinklers, controllers and automatic control valves to include in operation and maintenance manuals.
- B. Operation Instructions – Submit 3 written operating instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.
 - 1. Controller Charts:
 - a. Do not prepare charts until Construction Manager and Owner has reviewed record (as-built) drawings.
 - b. Provide one controller chart for each automatic controller installed.
 - 1) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2) Chart shall be blueline print of actual “as-built” system, showing area covered by that controller.
 - c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
 - d. Following review of charts by Construction Manager and Owner, they shall be hermetically sealed between two layers of 20-mm thick plastic sheet.
 - e. Charts shall be completed and reviewed prior to final review of irrigation system.

1.7 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. Impact Sprinklers: Three units for each type and size installed.
 - 2. Spray Sprinklers: Three units for each type and size installed.
 - 3. Bubblers: Ten units for each type and size.
 - 4. Emitters: Ten units for each type and size.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and

experience necessary for this Project, and financial stability, submit if requested by Consultant, prior to contract award the following:

1. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
 - a. Name of project.
 - b. Location.
 - c. Owner.
 - d. Brief description of work and project budget.

B. Special Requirements:

1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.
2. Tolerances – Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
3. Coordination with Other Contractors – Protect, maintain, and coordinate Work with Work under other Section.
4. Damage to Other Improvements – Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference – Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Construction Manager and Owner.

1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- C. Handling of PVC Pipe – Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it

to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.10 PROJECT CONDITIONS

A. Protection of Property:

1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Existing Trees:

1. All trenching or other Work under limb spread of any and all evergreens or low branching deciduous material shall be done by hand or by other methods so as to prevent damage to limbs or branches.
2. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

C. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does occur, Utility Owner shall repair all damage. Contractor shall pay all costs of such repairs unless other arrangements have been made.
2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

D. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Construction Manager's written permission.
- E. Replacement of Paving and Curbs – Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.
- F. Warranty/Guaranty – Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guaranty workmanship for similar period.
1. Settling of backfilled trenches that may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.
 2. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Hard Copper Tube: ASTM B 88, Type L, and ASTM B 88, Type M, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- D. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SDR 11.5 and SDR 15.
1. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
- E. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.

1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 2. PE Socket-Type Fittings: ASTM D 2683.
- F. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 200 psig.
1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 2. PE Socket-Type Fittings: ASTM D 2683.
- G. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.
1. PVC Socket Fittings: ASTM D 2466, Schedule 80.
 2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
 3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
- H. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.
1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
 2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Sheet.
- C. Material: LLDPE film of 0.008-inch minimum thickness.

- D. Color: Natural.

2.4 MANUAL VALVES

A. Curb Valves:

1. Description:

- a. Standard: AWWA C800.
- b. NPS 1 and Smaller Pressure Rating: 150 psig.
- c. NPS 1-1/4 to NPS 2 Pressure Rating: 150 psig.
- d. Body Material: Brass or bronze with ball or ground-key plug.
- e. End Connections: Matching piping.
- f. Stem: With wide-tee head.

B. Curb-Valve Casing:

- 1. Standard: Similar to AWWA M44 for cast-iron valve casings.
- 2. Top Section: Telescoping, of length required for depth of burial of curb valve.
- 3. Barrel: Approximately 3-inch diameter.
- 4. Plug: With lettering "WATER."
- 5. Bottom Section: With base of size to fit over valve.
- 6. Base Support: Concrete collar.

- C. Shutoff Rods for Curb-Valve Casings: Furnish one steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Brass Ball Valves:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded or solder joint if indicated.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full or regular.

E. Bronze Ball Valves:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.

- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded or solder joint if indicated.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full or regular.

F. Plastic Ball Valves:

1. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating: 150 psig.
- c. Body Material: PVC.
- d. Type: Union.
- e. End Connections: Socket or threaded.
- f. Port: Full.

G. Bronze Gate Valves:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. Class: 125.
- c. CWP Rating: 200 psig.
- d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
- e. Ends: Threaded or solder joint.
- f. Stem: Bronze, nonrising.
- g. Disc: Solid wedge; bronze.
- h. Packing: Asbestos free.
- i. Handwheel: Malleable iron, bronze, or aluminum.

H. Iron Gate Valves, Resilient Seated:

1. Description:

- a. Standard: AWWA C509.
- b. Pressure Rating: 200 psig minimum.
- c. Body Material: Ductile or gray iron with bronze trim.
- d. End Connections: Mechanical joint or push-on joint.
- e. Interior Coating: Comply with AWWA C550.
- f. Body Design: Nonrising stem.
- g. Operator: Stem nut.
- h. Disc: Solid wedge with resilient coating.

I. Iron Gate Valve Casings:

- 1. Standard: AWWA M44 for cast-iron valve casings.

2. Top Section: Adjustable extension of length required for depth of burial of valve.
 3. Barrel: Approximately 5-inch diameter.
 4. Plug: With lettering "WATER."
 5. Bottom Section: With base of size to fit over valve.
 6. Base Support: Concrete collar.
- J. Operating Wrenches for Iron Gate Valve Casings: Furnish one steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.
- K. Iron Gate Valves, NRS:
1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: All bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- L. Iron Gate Valves, OS&Y:
1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: All bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

2.5 PRESSURE-REDUCING VALVES

- A. Water Regulators:
1. Description:
 - a. Standard: ASSE 1003.
 - b. Body Material: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and NPS 3.
 - c. Pressure Rating: Initial pressure of 150 psig.
 - d. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.
- B. Water Control Valves:

1. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - a. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - b. Pattern: Angle-valve design.
 - c. Trim: Stainless steel.
 - d. Pressure Rating: Initial pressure of 150 psig minimum.
 - e. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

1. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

B. Plastic, Automatic Control Valves:

1. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.7 AUTOMATIC DRAIN VALVES

- ### A.
1. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.8 TRANSITION FITTINGS

- ### A.
1. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Plastic-to-Metal Transition Fittings:

1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Description: MSS SP-107, PVC four-part union. Include one brass threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.9 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

2.10 SPRINKLERS

- A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

- B. Plastic, Exposed, Impact-Drive Rotary Sprinklers:

- 1. Description:

- a. Construction: ABS and corrosion-resistant metals.
 - b. Mounting: Above ground, exposed on riser.

- C. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

- 1. Description:

- a. Body Material: ABS.
 - b. Nozzle: ABS.
 - c. Retraction Spring: Stainless steel.
 - d. Internal Parts: Corrosion resistant.

- D. Plastic, Pop-up, Impact-Drive Rotary Sprinklers:

- 1. Description:

- a. Case: ABS.
 - b. Pop-up Height: 4 inches minimum aboveground to nozzle.
 - c. Sprinkler Construction: ABS and other corrosion-resistant metals.

- E. Plastic, Surface Spray Sprinklers:

- 1. Description:

- a. Body Material and Flange: ABS.
 - b. Pattern: Fixed, with flow adjustment.

- F. Plastic, Surface, Pop-up Spray Sprinklers:

- 1. Description:

- a. Body Material and Flange: ABS.
 - b. Pattern: Fixed, with flow adjustment.

- 2. Capacities and Characteristics:

- a. Pop-up Height: 4 inches minimum.
- b. Nozzle: ABS.

G. Plastic, Pop-up Spray Sprinklers:

1. Description:

- a. Body Material: ABS.
- b. Nozzle: ABS.
- c. Retraction Spring: Stainless steel.
- d. Internal Parts: Corrosion resistant.
- e. Pattern: Fixed, with flow adjustment.
- f. Pop-up height: 4" min.

H. Plastic Shrub Sprinklers:

1. Description:

- a. Body Material: ABS or other plastic.
- b. Pattern: Fixed, with flow adjustment.

2.11 QUICK COUPLERS

- A. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

2.12 DRIP IRRIGATION SPECIALTIES

- A. Drip Irrigation Systems not acceptable for this project.

2.13 CONTROLLERS

A. Description:

- 1. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
- 2. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 - a. Body Material: Enameled-steel sheet metal.
 - b. Mounting: Surface type for wall.
- 3. Control Transformer: 24-V secondary, with primary fuse.
- 4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

- a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
 - b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
 - c. Surge Protection: Metal-oxide-varistor type on each station and primary power.
5. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
 6. Smart Controllers: Use ET, tested in accordance with IA SWAT Climatological Based Controllers 8th Draft Testing Protocol and compliant with ASHRAE Standard 189.1.
 7. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 - a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 - b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 - c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.14 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - a. Size: As required for valves and service.
 - b. Sidewall Material: PE, ABS, or FRP.
 - c. Cover Material: PE, ABS, or FRP.
 - 1) Lettering: " IRRIGATION."

B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 SITE CONDITIONS, LANDSCAPE PLAN REVIEW AND COORDINATION

- A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

- B. Contractor is responsible to notify Owner of any field conditions that vary from the conditions shown on the approved Irrigation Shop Drawings. If Contractor fails to notify Owner of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.2 STATIC PRESSURE VERIFICATION

- A. Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Construction Manager. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.3 INSPECTION

- A. Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.
 - 1. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.
 - 2. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.

3.4 PREPARATION

- A. Staking shall Occur as Follows:
 - 1. Mark with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Owner 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by Owner/Landscape Architect prior to Owner review of irrigation staking. Owner will advise installer as to the amount of staking to be prepared. Owner will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.
 - 2. Contractor shall contact Owner if field spacing varies by +/- 10% of the spacing shown on the irrigation approved shop drawings. If Contractor fails to notify Owner of variances exceeding 10%, Owner assumes full responsibility for the costs associated with any required system modifications deemed necessary by the Owner.
 - 3. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Owner/Landscape Architect, do not install irrigation equipment in these areas until Owner has reviewed equipment staking.
- B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95%

Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

- C. Trenching – Trench excavation shall follow, as much as possible, layout shown on approved shop drawings. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
1. Clearances:
 - a. Piping 3 Inches and Larger – Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
 - b. Piping smaller than 3 inches – Trenches shall have a minimum width of 7 inches.
 - c. Line Clearance – Provide not less than 6 inches of clearance between each line and not less than 12 inches of clearance between lines of other trades.
 2. Pipe and Wire Depth as recommended by irrigation engineer with minimums as noted in Paragraph 3.5. D below:
 3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density or backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as through pipe were installed in open trench.
 4. Vibratory Plow – Non-pressure piping may be installed through use of vibratory plow method if consultant determines soil conditions are satisfactory for this method of installation. Vibratory plowing does not relieve installer of minimum pipe depths.

3.5 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."
- B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- D. Provide minimum cover over top of underground piping according to the following:
 1. Irrigation Main Piping: Minimum depth of 24 inches below finished grade.
 2. Circuit Piping: 12 inches.
 3. Drain Piping: 12 inches.
 4. Sleeves: 12 inches minimum.
 5. Piping inside Animal Exhibits: 24 inches.

3.6 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's approval before excavation.

3.7 PIPING INSTALLATION

- A. Location and Arrangement: As shown on approved shop drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.
- F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- H. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- I. Install expansion loops in control-valve boxes for plastic piping.
- J. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- K. Install ductile-iron piping according to AWWA C600.
- L. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- M. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
- N. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
- O. Install piping in sleeves under parking lots, roadways, and sidewalks.
- P. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints.
- Q. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 and Larger: AWWA transition couplings.

2. Aboveground Piping:
 - a. NPS 2 and Smaller: Plastic-to-metal transition unions.
 - b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.
- R. Install dielectric fittings for dissimilar-metal pipe connections according to the following:
 1. Underground Piping:
 - a. NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
 - b. NPS 2-1/2 and Larger: Prohibited except in control-valve box.
 2. Aboveground Piping:
 - a. NPS 2 and Smaller: Dielectric union.
 - b. NPS 2-1/2 to NPS 4: Dielectric flange.
 - c. NPS 5 and Larger: Dielectric flange kit.
 3. Piping in Control-Valve Boxes:
 - a. NPS 2 and Smaller: Dielectric union.
 - b. NPS 2-1/2 to NPS 4: Dielectric flange.
 - c. NPS 5 and Larger: Dielectric flange kit.

3.8 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
- F. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.
- G. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube

Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

- H. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.
- I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- J. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.9 VALVE INSTALLATION

- A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
- B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
 - 1. Install valves and PVC pipe with restrained, gasketed joints.
- C. Aboveground Valves: Install as components of connected piping system.
- D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.
- E. Throttling Valves: Install in underground piping in boxes for automatic control valves.
- F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.10 SPRINKLER INSTALLATION

- A. Install sprinklers after hydrostatic test is completed.
- B. Install sprinklers at manufacturer's recommended heights.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

3.11 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

- A. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.12 CONNECTIONS

- A. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
- B. Connect wiring between controllers and automatic control valves.

3.13 IDENTIFICATION

- A. Identify system components.
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
 - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches.

3.14 FIELD QUALITY CONTROL

- A. Flushing – After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthestmost valves. Cap risers after flushing.
- B. Testing – Conduct tests in presence of Construction Manager. Arrange for presence of Construction Manager 48 hours in advance of testing. Supply force pump and all other test equipment.
 - 1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure of 120 PSI, whichever is greater, for a period of 2 hours.
 - 2. Leakage, Pressure Loss – Test is acceptable if no loss of pressure is evident during the test period.
 - 3. Leaks – Detect and repair leaks.
 - 4. Retest system until test pressure can be maintained for duration of test.
 - 5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.

C. Walk-Through for Substantial Completion:

1. Arrange for Construction Manager and Owner presence 48 hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for Construction Manager and Owner at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
6. Supply Consultant with prints of irrigation as-builts prior to scheduling substantial completion walk-through.

D. Walk-Through for Final Completion:

1. Arrange for Construction Manager and Owner presence 48 hours in advance of walk-through.
2. Show evidence to Construction Manager that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
3. Operate each zone, in its entirety for Construction Manager at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Construction Manager shall be reworked to complete satisfaction of Construction Manager.
5. If after request to Construction Manager for walk-through for Final Completion of irrigation system, Construction Manager finds items during walk-through which have not been properly adjusted, reworked or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Construction Manager to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

3.15 ADJUSTING

- A. Upon completion of installation, “fine-tune” entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

1. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Construction Manager, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.
2. All sprinkler heads shall be set perpendicular to finish grade unless otherwise noted on Construction Plans or directed by Construction Manager.

3. Areas which do not confirm to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.16 CLEANING

- A. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash or debris generated by installation of irrigation system.

3.17 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

END OF SECTION 32 84 00

SECTION 32 91 15

PLANTING SOILS AND ANIMAL SUBSTRATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

1. Planting Soils.
2. Exterior Animal Substrates.
3. Interior Animal Substrates.
4. Geotextile Drainage Mat.
5. Geotextile Fabric.

- B. Related Requirements:

1. Division 01 Section "Temporary Tree and Plant Protection."
2. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
3. Division 31 Section "Turf and Grasses" for seeding and sodding requirements.
4. Division 32 Section "Plants" for coordination with planting work.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
 - J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
 - K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
 - L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
 - M. SSSA: Soil Science Society of America.
 - N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
 - O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
 - P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
 - Q. USCC: U.S. Composting Council.
- 1.4 PREINSTALLATION MEETINGS
- A. Preinstallation Conference: Conduct conference at Project site.
- 1.5 ACTION SUBMITTALS
- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
 - 4. Material Certificates: For each type of soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

- B. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For each testing agency.
- B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
 - 1. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing soil, provided by Owner.
- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by one of the following: Owner, soil scientist (CPSS) certified by SSSA, soil classifier (CPSC) certified by SSSA, or soil scientist (RPSS) registered by the National Society of Consulting Soil Scientists under the direction of the testing agency.
 - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Bulk Density: Analysis according to core method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.
- D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT SERA-6, including the following:
 1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.

7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil, as described in paragraph 2.1 suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per cubic yard.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per cubic yard.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.
 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS

- A. Planting-Soil: Provide soil mixes as indicated on drawings, modified to produce viable planting soil. Using preconstruction soil analyses and materials specified in other articles of this Section, amend soil to become planting soil complying with the following requirements:

1. Particle Size Distribution by USDA Textures: Classified as sandy loam, loam or silt loam soil according to USDA textures.
2. Percentage of Organic Matter: Minimum 6 percent by volume.
3. Soil Reaction: pH of 6 to 7.5.
4. CEC of Total Soil: Minimum 15 meq/100 mL at pH of 7.0.
5. Soluble-Salt Content: <2 dS/m measured by electrical conductivity.
6. Bulk Density: 1.45 g/cu. cm to 1.60 g/cu. cm at 85 percent compaction.
7. Total Porosity: Minimum 50 percent at 85 percent compaction.
8. Macro Porosity: Minimum 10 percent at 85 percent compaction.
9. Fertility: As recommended by soil test results.
10. Microbiological Content: As recommended by soil test results.
11. RCRA Metals: Below maximum limits established by the EPA and all State and local jurisdictions.
12. Sodium Absorption Ratio (SAR): <2.
13. Phytotoxicity: Below phytotoxicity limits established by SSSA.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 3. Form: Provide lime in form of ground dolomitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- E. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 1. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
 2. Reaction: pH of 5.5 to 8.
 3. Soluble-Salt Concentration: Less than 2 dS/m.
 4. Moisture Content: 35 to 55 percent by weight.
 5. Organic-Matter Content: 50 to 60 percent of dry weight.

6. Particle Size: Minimum of 100 percent passing through a 3/4 sieve.

- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 2 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 2 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Organic Fertilizers: Such as bone meal, blood meal, wood ashes, etc.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Slow Release Bio-Fertilizers: See Division 32 "Plants."
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.5

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2.5 ANIMAL SUBSTRATES

- A. Interior Animal Substrates: Natural substrates inside animal holding buildings should be clean, dry sandy loam. Install to depths and locations as indicated on drawings.
- B. Exterior Animal Substrates: Natural substrates in exterior animal accessible spaces should be clean material free of deleterious material as indicated on drawings. Substrate depths as indicated on drawings.

2.6 GEOTEXTILE FABRICS

- A. Geotextile Drainage Mat for Shotcrete and Concrete Retaining Walls: Basis of Design for quality is Enkadrain, B10 manufactured by Colbond. www.colbond.com or approved equal.

- B. Geotextile Fabric for Raised Shotcrete Planters: Basis of Design for quality is MIRAFI N Series, 180N, manufactured by Tencate, Pendergrass, GA, www.tencate.com or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.
- D. Contractor shall give Owner's Representative sufficient notice before soil mix installation to allow inspection of the site to ensure that subsoil is free of debris and meets penetrability standards.

3.2 GEOTEXTILE MAT AND FABRIC

- A. Install as per drawings and manufacturer's instructions in locations shown on drawings.

3.3 PREPARATION OF UNAMENDED SOIL BEFORE AMENDING

- A. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- B. Unsuitable Materials: Clean soil to contain a combined maximum of 5 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- C. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.4 PLACING AMENDED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply amended soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply 4" thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade.
- C. Application: Spread remaining planting soil to total depth on-grade as indicated on drawings, but **not less than required to meet finish grades after settlement**. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each lift of planting soil to 85 percent of maximum Standard Proctor density according to ASTM D 698.
 1. Soil that has been compacted should drain water at the rate of 1" per hour. After placing a total of 24" of soil or reaching final grade, whichever comes first, water lightly for at least three hours to encourage settling before adding next layer of soil, Repeat once final grade is reached.
 2. Construction traffic must be limited within areas planned for vegetation.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- F. Confirmation of finish grades: In all planted areas a layer of soil mix per drawing designations shall be placed as called for so the bed surface will be at the specified finish grade when mixture has settled. Grades shall be true to line, fair to curvature and accurate to grades shown on the Drawings and as directed by Architect. Finish grades are measured from the top of the finished soil mix after settling per Paragraph 3.4 D.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests:
 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
 2. Performance Testing: For each amended planting-soil type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
- C. Soil will be considered defective if it does not pass tests.
- D. Prepare test reports.
- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.6 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Vehicle traffic.
 4. Foot traffic.
 5. Erection of sheds or structures.
 6. Impoundment of water.
 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.7 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

3.8 SPECIAL CLEANUP FOR EXHIBIT AREAS

- A. Note: It is essential that no hard loose materials larger than 1/2" in any dimension be left in any animal area or within animal reach. All metal, wood, plastic, or other construction debris shall be removed from these areas. Each contractor shall be responsible for compliance with this requirement for work in his/her area and shall be liable for repair or replacement of work (including exhibit windows) damaged by an animal using objects within its reach as a result of work in this Section.

END OF SECTION 32 91 15

SECTION 32 92 00
TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sodding

B. Related Requirements:

1. Division 32 Section "Plants" for trees, shrubs, ground covers, and other plants.
2. Division 32 Section "Planting Soils and Animal Substrates."

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Planting Soils and Animal Substrates" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Product Certificates: For fertilizers, from manufacturer.

- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and meadow establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Lawncare Manager.
 - c. Landscape Industry Certified Lawncare Technician.
 - 5. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sold Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding". Delivery sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.7 FIELD CONDITIONS

- A. Planting Restrictions: Plant during the following period. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Planting Period: September 15th through June 1st.
 2. Obtain written Owner approval to plant outside of the typical planting period.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
- B. Turfgrass Species: As indicated on drawings.

2.2 FERTILIZERS

- A. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. **Do not use restricted pesticides unless authorized in writing by Owner.**
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Planting Soils and Animal Substrates."
- B. Moistening prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as approved by Landscape Architect but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1 1/2 inches (38 mm) below sod.

3.5 TURF RENOVATION

- A. Renovate existing turf in project staging area.
- B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish turf where settlement or washout occur or where minor regrading is required.
 - 2. Install new planting soil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Do not use herbicides unless approved by Owner.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- I. Apply soil amendment as indicated on drawings and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
 - 1. Initial Fertilizer: Slow-release fertilizer applied according to manufacturer's recommendations.
- J. Apply seed and protect with straw mulch as required for new turf.
- K. Water newly planted areas and keep moist until new turf is established.

3.6 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments only as authorized by Owner in writing to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as directed by Owner.
- D. Turf Postfertilization: Apply slow-release fertilizer when grass is dry, and only as directed by Owner. Do not apply fertilizer in animal areas, or within animal reach.

3.7 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. **Receive written authorization from Owner before each application is performed.**
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as directed by Owner to treat already-germinated weeds and according to manufacturer's written recommendations.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.9 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
 - 1. Sodded Turf: until Substantial Completion.
 - 2. Additional Maintenance Period Option: Provide price to Owner for extending maintenance period for 12 months after Substantial Completion.

END OF SECTION 32 92 00

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Plants.
- 2. Fertilizers.
- 3. Wood Mulch.

- B. Related Requirements:

- 1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
- 2. Division 32 Section "Planting Soils and Animal Substrates."
- 3. Division 32 Section "Turf and Grasses" for sod and erosion-control materials.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when

removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Planting Soils and Animal Substrates" for drawing designations for planting soils.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 COORDINATION

- A. Coordination with Seeded Areas: Plant trees, shrubs, and other plants after finish grades are established and before seeding areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting seeded areas, protect seeded areas, and promptly repair damage caused by planting operations.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 30 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: Submit samples with written certification of compliance at least 30 days prior to beginning work covered in this section for each of the following:
 - 1. Wood Mulch: 1 gallon sample.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Plant List: Showing sources, quantities, species and sizes.
- E. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Horticultural Technician.
 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Owner or Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Owner or Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials 90 days in advance of delivery to site.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.

- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball.
- E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.11 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during the following period. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
 - 1. Planting Period: September 15th through June 1st.
 - 2. Obtain written Owner approval to plant outside of the typical planting period.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be

- D. obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.
- G. Container stock shall have been grown in its delivery container for not less than six (6) months, but not more than (2) years.

2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 10-gram tablets.
 - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

- A. Wood Mulch: Double shredded hardwood chips ranging in size from 3/4" to 1 1/2".

2.4 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. **No pesticides are to be used without written authorization by Owner.**

2.5 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

- B. Burlap: Non-synthetic, biodegradable.
- C. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 - 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Planting Soils and Animal Substrates."
- B. Placing Planting Soil: Place amended planting soil over exposed subgrade per requirements of "Planting Soils and Animal Substrates" Section.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate approximately three times as wide as ball diameter for all stock.
 - 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 7. Maintain supervision of excavations during working hours.
 - 8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
 - 9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped and Container Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
 - 1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole. Quantity: per manufacturer's written recommendations.
 - 5. Application of Mycorrhizal Fungi: Install product to prepared soil according to manufacturer's written recommendations.
 - 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.7 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING AREA MULCHING

- A. Wood Mulch: Install 3" of wood mulch in all areas receiving plantings, except rain gardens and turf areas.
 - 1. Do not place mulch within 3 inches of trunks or stems.

3.9 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments only as directed by Owner in writing to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards.

3.10 PESTICIDE APPLICATION

- A. Do not apply pesticides and other chemical products and biological control agents without written authorization from Owner.

3.11 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace new or existing trees that are more than 25 percent dead or in an unhealthy condition before the end of the warranty period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. For trees smaller than 4" in caliper size: Replace with tree of same size and species.
 - 2. For trees larger than 4"; Provide one new 4" tree of same size as those being replaced for each tree >4" or <12".
 - 3. For trees larger than 12" in diameter: Provide one new tree of 4-inch caliper size for every 8" in caliper being replaced. (Example: Replace 24" tree with three 4" trees).
 - 4. Species of Replacement Trees: Species selected by Architect.

3.12 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.
- F. Note: It is essential that no hard loose materials larger than 1/2" in any dimension be left in any animal area or within animal reach. All metal, wood, plastic, or other construction debris shall be removed from these areas. Each contractor shall be responsible for compliance with this requirement for work in his/her area and shall be liable for repair or replacement of work (including exhibit windows) damaged by an animal using objects within its reach as a result of work in this Section.

3.13 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: Until Substantial Completion.
 - 2. Additional Maintenance Period Option: Provide price to Owner for extending maintenance period for 12 months after Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: Until Substantial Completion.
 - 2. Additional Maintenance Period Option: Provide price to Owner for extending maintenance period for 12 months after Substantial Completion.

END OF SECTION 32 93 00

SECTION 33 40 00
DRAINS AND CULVERTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Culverts and storm drains shall conform to all of the requirements of the General Specifications and Standard Plans of the Sewerage & Water Board (S&WB) of New Orleans (the latest revision) except as noted

1.02 GENERAL REQUIREMENTS

- A. The Contractor shall furnish all materials, equipment, labor and supervision to remove the existing deteriorated main, install new mains and fittings, including appurtenances such as tie-ins to existing system, lumber foundation, bedding, backfilling, necessary dewatering and by-passing during the execution of this contract.
- B. All workmanship, material and tests shall conform with Section E of the General Specifications of the S&WB and S&WB Standard Drawing No. 7260-D except as noted herein.
- C. The Contractor shall notify the Chief of Network Engineering of the S&WB in writing not less than three or more than ten working days in advance of starting the job so as to schedule the inspection of the work. Failure to do so prior to starting work will result in the Contractor being required to expose the bedding on all pipe previously installed.
- D. The Contractor may use more than one crew in performing work in various sections of a system at a given time, provided he has the approval of the DPW Director.
- E. The Contractor performing work under this contract shall be required to coordinate his operations with the S&WB and other utilities prior to making any excavation so that the location of their services can be identified. The Contractor shall exercise caution in making excavations to avoid damage to these services and other utilities.
- F. The Contractor will be furnished a list of the locations of water and sewer house connections. It will be the Contractor's responsibility to verify the location of these so as to avoid damage. Furnishing this information should not be construed as a waiver of the Contractor's liability, but rather an attempt on the part of the S&WB to minimize the Contractor's hazard. The existing house connections submitted in the list are from S&WB records and could vary from the actual location. Any damage to the existing water, sewer and drain connections resulting from negligence shall be repaired by the S&WB at the expense of the Contractor. The Contractor is also responsible for damage to other utilities and the property of others.
- G. Existing drain house connections shall be tied into the new mains. No new drain house services shall be installed.

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Where the entire drain line is replaced between manholes, the drain pipe shall be reinforced concrete pipe conforming to Section C of the General Specifications of the S&WB and to the Standard City Plans, unless otherwise noted. Installation of drain lines, including bedding and foundation lumber, shall be in accordance with S&WB Standard Drawings No. D-3809, No. D-3810, No. D-3933 and D-3934.
- B. The new drain lines and house connections, where required, shall be installed at the existing elevations and locations indicated, unless changed by the DPW Director. The Contractor shall schedule his work so that the drain lines and catch basin connections between two manholes are completed before moving to another location (this will minimize the spillage of storm water into an open trench). The Contractor shall isolate the block where the work is in progress by plugging the upstream and downstream manholes. Should the storm water build up to within three feet of the top of the upstream manhole, or if directed by the DPW Director, the Contractor shall pump the water to the downstream manhole or to a nearby catch basin, through bypass pumping. No mains or lines shall be left open overnight; a temporary tie-in shall be made between the end of the new main and the existing, and plugs at manholes shall be removed so as to allow flow to continue until work is resumed.
- C. Backfill material shall be pumped sand and shall be placed at or near optimum moisture content and compacted according to one of the following procedures:
 - 1. Backfill material shall be placed in layers not to exceed 12 inches. Each layer shall be compacted to a minimum of 95 percent of maximum density using approved mechanical compaction equipment, or:
 - 2. Backfill material may be placed in layers not exceeding 3 feet by thoroughly flooding and compacting each layer to a minimum of 95 percent maximum density at or near optimum moisture content using approved mechanical compaction equipment, prior to placing a subsequent layer. During placement, backfill materials shall be thoroughly saturated with water and satisfactory drainage of materials shall be provided. The above backfill material compaction procedures shall be applied also for any service connections and point repairs.
- D. Filter cloth around the joints of drain lines shall be non-woven conforming to LaDOTD Specification Section 1019, class B.

3.02 DRAIN HOUSE CONNECTIONS

- A. All existing drain house connections shall be removed and replaced with new PVC pipe from the new drain line to one (1') foot behind the curb where it will be tied to the existing drain house connection pipe.
- B. The need for replacing existing drain house connections from the back of the curb to the property line (or any point between) shall be determined by the S&WB after field inspection or as indicated on the drawings. The new pipe will be tied to the existing pipe at that point.
- C. If the existing drain line is being removed and not replaced, or if the S&WB determines it is necessary, an alternate method may be utilized by connecting the existing drain house connections into

a PVC collector line located behind the curb and tied into the catch basins or manholes, as directed by the S&WB.

- D. The new house connection pipe may be connected to the new reinforced concrete pipe by drilling the concrete pipe and by using a rubber boot (Kor-n-Seal boot or approved equal) or sand impregnated PVC bell grouted in the concrete pipe, to connect the new PVC pipe.
- E. No bends greater than 45 degrees will be allowed in drain house connection pipe.
- F. No drain house connection shall be installed in the corners of catch basins. All connections shall be in the side or back of the catch basins.
- G. All pipes and fittings shall be approved by the S&WB. The connection of any two dissimilar house connection materials shall be accomplished by the installation of a "No-Hub" coupling consisting of a neoprene sleeve and bushing adapter and two stainless steel bands. The coupling shall be manufactured in strict accordance with Fernco specification, or approved equal.
- H. Where it is necessary to connect the drains to existing manholes, catch basins, or canals, the existing short bell pieces remaining in the wall of the structure shall be inspected. If in bad condition, the short bell pieces shall be broken out and new short bell pieces inserted to the full thickness of the walls and permanently grouted (see S&WB Dwg. 6178-B-6). The annular space between the concrete pipe and the wall of the structure shall be grouted with a type three, high early strength cement, or quick setting EMBECO or similar material.
- I. If a PVC pipe is to be connected to a manhole or other concrete or brick drainage structure, the Contractor shall use a sand-impregnated PVC stub, grouted with cement grout as specified above, for the manhole connection.
- J. Drain house connections shall be backfilled as described herein for drain lines.

3.03 POINT REPAIRS OF EXISTING DRAIN LINES

- A. Where the existing drain line has to be removed and replaced with new concrete pipe, said pipe fittings shall conform with Section E of the S&WB General Specifications. Bedding and foundation lumber for the drain line shall conform with S&WB drawings No. D-3809, No. D-3910, No. D-3933 and No. D-3934. Bedding and foundation lumber shall extend under the existing pipe for a distance of not less than 12 inches from the end of pipe to insure proper bedding under the coupling.
- B. The Contractor shall make point repairs to the lines at specific locations shown on the drawings and as listed in the schedule of bid prices. Point repairs shall be made by dry type and shall conform to Section XII of NASSCO (National Association of Sewer Service Companies). The Contractor shall make an excavation to expose a basic "ten (10) linear feet" of main per point repair. Any additional footage of repair beyond the ten-foot minimum for each point repair shall be approved by the DPW Director or as indicated on the Drawings as "Beyond point repair". The Contractor is required to have all materials and equipment on hand prior to the start of excavation so that there will be a minimum of inconvenience to the residents. All trenches must be backfilled at the end of the day. Backfill will be in accordance with the same as described herein for new drain lines.
- C. For drain point repairs, and for all other drain repairs, the connection of any two dissimilar materials shall be accomplished by the installation of a "no-hub" coupling consisting of a neoprene sleeve and bushing adapter, two stainless steel bands, and stainless steel screws. The coupling shall be manufactured in strict accordance with Fernco coupling specifications, or approved equal.

- A. At the completion of the point repair or replacement of mains between manholes, and prior to final acceptance, the S&WB may inspect the mains with a remote controlled television unit or by visual inspection of large lines. The Contractor will be required to repair, at his expense and in an approved manner, all defects in his workmanship disclosed by these tests and inspections before final acceptance.

3.05 AS-BUILT DRAWINGS

- A. The Contractor shall furnish a set of "as built" drawings upon completion of the work and prior to final inspection. These drawings shall be a legibly marked set of prints of the Contract Drawings, revised to show clearly all field changes.

END OF SECTION

SECTION 33 41 00
MANHOLES, CATCH BASINS, DROP INLETS, AND CLEAN-OUTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This work consists of the construction and adjustment of manholes, catch basins, drop inlets, and cleanouts in accordance with the General Specifications and Standard Plans of the Sewerage & Water Board of New Orleans (latest revision), and in conformity with lines shown on the plans or established. The surrounding structure shall be backfilled and compacted in accordance with Sub-section 33 40 00.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

- 3.01 MANHOLES: (No. 1, No. 2, No. 3, Standard Drain Manholes, Special Drain Manholes and Special Conflict Manholes.) Manholes shall be built according to the Standard Plans of the S&WB and/or as indicated on the plans.
- 3.02 CATCH BASIN ADJUSTMENTS: (Type A, type B and type C.)
 - A. Type A: The work consists of making slight adjustments in alignment and raising or lowering the elevation of the casting, no additional walls are required.
 - B. Type B: The work consists of building a wall inside the wall and outside of the front wall of the basin or racking over or drawing in the rear wall and building a brick wall outside of the front of the front wall or vice versa, and preserving and reusing the footing courses and subgrade lumber and the side walls.
 - C. Type C: The work consists of removing the basin completely and rebuilding it either at the same location or at a different location, as directed.
- 3.03 CATCH BASINS AND DROP INLETS: (No. 1, Double No. 1, No. 2, No. 3, No. 4, No. 5, Standard Catch Basin, Standard Drop Inlet, Single and Double Mountable Catch Basins.) The structures shall be built conforming to the Standard Plans of the S&WB.
- 3.04 REHABILITATE EXISTING CATCH BASIN: The work consists of reshagging inside, stopping leaks and re-sealing where required.
- 3.05 REHABILITATE EXISTING MANHOLE: The work consists of reshagging inside, stopping leaks and re-sealing where required.
- 3.06 TAP-IN TO EXISTING DRAIN LINE: The work consists of breaking out the existing drain line and tapping the new drain line into it, including stub.

3.07 ADJUST MANHOLE OR DROP INLET: The work consists of adjusting manholes or drop inlets to grade with brick and mortar where directed.

3.08 CATCH BASINS AND DROP INLETS: (No. 1, Double No. 1, No. 2, No. 3, No. 4, No. 5, Standard Catch Basin, Standard Drop Inlet, Single and Double Mountable Catch Basins.) The structures shall be built conforming to the Standard Plans of the S&WB.

3.09 SIX (6") INCH DRAIN CLEANOUT FOR ROOF DRAIN: The work consists of installing new a cleanout box with casing for roof drain in accordance with plans.

3.10 CLEANOUT BOX IN EXISTING CULVERT AND NEW CULVERT: The work consists of installing a new brick cleanout box with casting in accordance with the plans.

3.11 PAYMENT

A. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
33 41 00 (01)	Tie into Drain Manhole	Each
33 41 00 (02)	Drain Cleanouts	Each

B. If not outlined in the table above, any costs in connection with this section shall be included in the contract prices for the items of work to which the work is incidental.

END OF SECTION

SECTION 33 42 36
STORMWATER TRENCH DRAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-sloped channel drain system.

1.02 RELATED SECTIONS

- A. Section 31 23 16 – Excavation
- B. Section 31 23 23 – Fill and Backfill
- C. Section 33 40 00 – Drains and Culverts

1.03 SUBMITTALS

- A. Comply with Section 01330 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating layout, materials, components, accessories, and dimensions.
- D. Warranty: Submit manufacturer's standard warranty. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, roots in excess of 1-1/2-in diameter, matted roots, brush, timber, concrete rubble, and other debris encountered to a depth of 18-in below original grade or 18-in beneath the bottom of foundations, whichever is deeper.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide pre-sloped channel drain system from single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, cool, dry area in accordance with manufacturer's instructions. Do not store materials in direct sunlight.
- C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. NDS, Inc., 851 North Harvard Avenue, PO Box 339, Lindsay, California 93247. Toll Free (800) 726-1994. Toll Free Fax (800) 726-1998. Phone (559) 562-9888. Fax (559) 562-4488. Website www.ndspro.com. E-Mail nds@ndspro.com.
- B. Or approved equal.

2.02 PRE-SLOPED CHANNEL DRAINS

- A. Dura Slope Channel Drain:

2.03 TRENCH DRAINS

- A. Dura Slope Poly Perforated Grate:

1. Part Number: DS-670
2. Description: 2-foot, UV Protected Structural Foam Polyolefin.
3. Grate Openings: 1/4 inches.
- 4.
5. Load: 61-175 psi. Medium duty traffic, auto, light trucks-rated at speeds less than 20 mph.
6. Color: Owner to approve.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive pre-sloped channel drain system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install trench drain system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Excavate trench to ensure proper bedding of concrete beneath and on both sides of channel.
- C. Install top of drain system level and to proper elevation.
- D. Ensure directional flow arrows located on bottom of channel are pointing in direction of flow, toward catch basin and/or evacuation outlet.
- E. Ensure catch basin is at required elevation and location to drain system.
- F. Apply silicon sealant to seal joints of drain system.
- G. Install and tape grates before placing concrete.
- H. Concrete:
1. Place concrete beneath and on both sides of drain system.
 2. Ensure concrete has a minimum compressive strength of 3,500 psi at 28 days.
 3. Concrete shall be as specified in Section 03300.
- I. Recess top of drain system to be 1/8 inch below concrete finish grade.

3.03 PROTECTION

- A. Protect installed pre-sloped channel drain system from damage during construction.

END OF SECTION

SECTION 33 46 00
SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Perforated-wall pipe and fittings.
- B. Geotextile filter fabrics.

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Drainage conduits, including rated capacities.
 - 2. Geotextile filter fabrics.

PART 2 PRODUCTS

2.01 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. NPS 8 (DN 200) and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
 - 3. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.02 SOIL MATERIALS

- A. Soil materials are specified in Section 31 23 23 – FILL AND BACKFILL.

2.03 WATERPROOFING FELTS

- A. Material: Shall have a thickness of 30 mil.

2.04 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.
 - 1. Survivability: AASHTO M 288 Class 2

2. Styles: Flat and sock.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 23 16 - EXCAVATION and Section 31 23 23 - FILL AND BACKFILL.

3.03 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches (150 mm) deep and 12 inches (300 mm) wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric or waterproofing felt over top of drainage course, per plan details. Overlap edges at least 4 inches (100 mm).
- J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.04 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches (150 mm)

between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.05 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches (150 mm) between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches (300 mm) of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric or waterproofing felt over top of drainage course, per plan details. Overlap edges at least 4 inches (100 mm).
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.06 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches (915 mm) unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping level.

3. Plaza Deck Subdrainage: Install piping level.
 4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm) unless otherwise indicated.
 5. Lay perforated pipe with perforations down.
 6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping according to ASTM D 2321.

3.07 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.08 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 33 40 00 – DRAINS AND CULVERTS.
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in piping, in manholes, or pits where indicated on plans.

3.09 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 33 40 00 DRAINS AND CULVERTS.
- B. Cleanouts for Foundation and Landscaping Subdrainage:
1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
 3. In nonvehicular-traffic areas, use NPS 4 (DN 100) cast-iron or PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
- C. Cleanouts for Underslab Subdrainage:
1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 2. Use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

- A. Comply with requirements for piping specified in Section 33 41 00 MANHOLE CATCHBASINS DROPINLETS CLEANOUTS. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation or underslab subdrainage to stormwater sump pumps.

3.11 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 31 20 01 EARTHWORK.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports

3.13 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

3.14 PAYMENT

- A. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
33 46 00 (01)	6" Perforated PVC Drain Line	Linear Foot
33 46 00 (02)	Yard Drains	Each

- B. If not outlined in the table above, any costs in connection with this section shall be included in the contract prices for the items of work to which the work is incidental.

END OF SECTION