

UNIVERSITY OF NEW ENGLAND

GODDARD HALL EXTERIOR SHELL

PROJECT MANUAL

PERMIT SPECIFICATIONS

11/17/10

PROJECT # 10538



PORT ■ CITY
ARCHITECTURE



UNIVERSITY OF NEW ENGLAND GODDARD HALL

TABLE OF CONTENTS

CONTRACT FORMS

Table of Contents
Contact Sheet
List of Drawings

CONDITIONS OF CONTRACT

Supplementary Conditions of the Contract for
University of New England Renovations

DIVISION 1

Section

01 11 00	Summary of the Work
01 23 00	Alternates
01 29 00	Payment Procedures
01 31 00	Project Management and Coordination
01 32 00	Construction Progress Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 00	References
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 73 00	Execution
01 73 29	Cutting and Patching
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Demonstration and Training

GENERAL REQUIREMENTS

DIVISION 3

Section

03 30 00	Cast-in-Place Concrete
03 37 13	Shotcrete

CONCRETE

DIVISION 4

Section

04 20 30	Select Masonry Cleaning
04 21 10	Select Removal and Replacement of Deteriorated Brick
04 46 40	Select Masonry Repointing

MASONRY

DIVISION 5

Section

05 12 00	Structural Steel
----------	------------------

METALS

05 30 00	Metal Decking
05 50 00	Metal Fabrication
05 51 00	Metal Stairs
05 52 13	Pipe & Tube Railing
<u>DIVISION 6</u>	<u>WOOD AND PLASTICS</u>
Section	
06 10 00	Rough Carpentry
06 40 13	Exterior Architectural Woodwork
<u>DIVISION 7</u>	<u>THERMAL AND MOISTURE PROTECTION</u>
Section	
07 21 00	Thermal Insulation
07 53 23	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 62 00	Sheet Metal Flashing and Trim
07 72 00	Roof Accessories
07 84 13	Penetration Firestopping
07 92 00	Joint Sealants
<u>DIVISION 8</u>	<u>DOORS AND WINDOWS</u>
Section	
08 11 13	Hollow Metal Frames
08 14 16	Flush Wood Doors
08 21 20	Stile and Rail Wood Doors and Wood Frames
08 31 13	Access Doors & Frames
08 71 00	Finish Hardware, Access Control, Low Voltage Wiring
08 80 00	Glazing
08 90 00	Louvers and Vents
<u>DIVISION 9</u>	<u>FINISHES</u>
Section	
09 26 00	Gypsum Board Assemblies
09 65 00	Resilient Flooring and Accessories
09 68 16	Carpeting
09 91 13	Exterior Painting
09 91 23	Interior Painting
<u>DIVISION 10</u>	<u>SPECIALTIES</u>
Section	
10 14 00	Signage
10 44 16	Fire Extinguishers
<u>DIVISION 14</u>	<u>CONVEYING SYSTEMS</u>
Section	
14 24 00	Hydraulic Elevators
<u>DIVISION 16</u>	<u>ELECTRICAL</u>
Section	
16 00 00	Electrical Core and Shell

DIVISION 21

Section

21 11 00 Fire Suppression Piping

DIVISION 31

Section

31 10 00 Site Clearing
31 20 00 Earth Moving
31 23 19 Dewatering
31 50 00 Excavation Support and Protection

DIVISION 32

EXTERIOR IMPROVEMENTS

Section

32 12 16 Asphalt Paving
32 14 00 Unit Paving
32 92 00 Turf and Grasses
32 93 00 Planting

DIVISION 33

UTILITIES

Section

33 05 14 Manholes
33 05 15 Catch Basins
33 11 00 Piping – Water Systems
33 31 00 Sanitary Sewerage Piping

Appendices

Geotechnical Report – Haley & Aldrich, Inc
Historic Mortar Analysis
Historic Mortar Analysis – Sample 1
Historic Mortar Analysis – Sample 2
Historic Mortar Analysis – Sample 3
B1.0 – Masonry Restoration General Notes
B1.1 – Masonry Restoration North
B1.2 – Masonry Restoration East
B1.3 – Masonry Restoration South
B1.4 – Masonry Restoration West

End of Table of Contents

University of New England
Goddard Hall

CONTACT SHEET

OWNER

University of New England
11 Beach Hills Road
Biddeford, Maine 04005
Tel (207) 283-0170 x2368
Fax (207) 284-1281
Email AThibeault@une.edu

Contact: Alan Thibeault

ARCHITECT

Port City Architecture, PA
65 Newbury Street
Portland, ME 04101
Tel (207) 761-9000
Fax (207) 761-2010
Email lita@portcityarch.com

Contact: Lita Semrau

GENERAL CONTRACTOR

Allied/Cook Construction
P.O. Box 1396
Portland, ME 04101
Tel (207) 772-2888
Fax (207) 885-5135
Email: matt@alliedcook.com

Contact: Matt Cook

STRUCTURAL ENGINEER

Becker Structural Engineers
75 York Street
Portland, ME 04101
Tel (207) 879-1838
Fax (207) 879-1822
Email dan@beckerstructural.com

Contact: Dan Burns

CIVIL ENGINEER

Site Design Associates
183 Park Row
Brunswick, ME 04011
Tel (207) 449-4275
Email tsaucier@sitedesignassociates.biz

Contact: Tom Saucier

MECHANICAL CONTRACTOR

Titan Mechanical, Inc.
P.O. Box 3927
Portland, ME 04104
Tel (207) 878-5223
Fax (207) 878-5235
Email: tsmith@titanmech.com

Contact: Tom Smith

ELECTRICAL CONTRACTOR

Favreau Electric
37 Jordan Avenue
Brunswick, ME 04011
Tel (207) 725-2005
Fax (207) 725-2920
Email: nealf@favreau-electric.com

Contact: Neal Favreau

**UNIVERSITY OF NEW ENGLAND
GODDARD HALL**

LIST OF DRAWINGS

T1.0	Title Sheet (Code Info.)
T1.1	Emergency Code Plan
C-1.00	Existing Conditions & Site Demolition Plan
C-1.01	Site Layout & Materials
C-1.02	Grading, Drainage, & Erosion Control Plan
C-1.03	Site Utility Plan
C-1.04	Landscape Plan
C-3.01	Site Details
S1	General Notes
S2	Foundation Plan
S3	First Floor Framing Plan
S4	Second Floor Framing Plan
S5	Third Floor Framing Plan
S6	Roof Framing Plan
S7	Shear-Wall Elevations
S8	Sections and Details
S9	Framing Section & Details
D1.0	Demo. Basement & First Floor
D1.1	Demo. Second & Third Floor
D1.2	Demo. Roof Plan
D2.0	Demo. Rear & Side Elevations
D2.1	Demo. Front & Side Elevations
A1.0	Lower Level Floor Plan
A1.1	First Floor Plan
A1.2	Second Floor Plan
A1.3	Third Floor Plan
A1.4	Roof Plan
A2.0	North Elevation
A2.1	South Elevation
A2.2	East Elevation
A2.3	West Elevation
A3.0	Doors & Windows Schedule
A4.0	Building Section
A4.1	Building Section
A4.2	Section Details
A4.3	Section Details
A5.0	Elevator Section
A5.1	Elevator & Stair Sections
A5.2	Stair Section
A5.3	Stair Section & Details
A5.4	Stair Plans

A5.5	Stair Plans
A5.6	Stair Details
M1.0	LL HVAC Plan
M2.0	LL Plumbing Plan
ES1.01	Electrical Site Plan
E0.01	Electrical Legend & Notes
E1.01	Lower Level Electrical Plans
E1.02	1 st Floor Electrical Plans
E1.03	2 nd Floor Electrical Plans
E1.04	3 rd Floor Electrical Plans
E1.05	Roof Electrical Plans
E2.01	One-Line & Schedules
FA0.01	Fire Alarm Legend & Notes
FA1.01	Fire Alarm Plans
FA1.02	Fire Alarm Plans
B1.0	Masonry Rest. Key & Gen. Notes
B1.1	Masonry Rest. at North Elev.
B1.2	Masonry Rest. at East Elev.
B1.3	Masonry Rest. at South Elev.
B1.4	Masonry Rest. at West Elev.

End of List of Drawings

**SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR
FOR THE UNIVERSITY OF NEW ENGLAND RENOVATIONS**

The Following is a list of regulations that must be observed at all times. This is due to the number and type of students and faculty on campus. All Contractors must be notified of these rules and they should be posted on the job site at all times.

1. No verbal or physical harassment of any type will be tolerated. This includes but is not limited to whistling, sexual comments, insults, etc. Any individual who acts improperly will be asked to leave campus immediately. No other warnings will be given.
2. All parking rules must be observed unless instructed otherwise by the Facilities Management Department. Parking permits can be obtained through the Security Office.
3. All workers are to stay within the work area unless instructed otherwise. All work is to be done between the hours of 7:00 a.m. and 5:00 p.m. on weekdays unless other arrangements are made. Loud noise and work in and around the residence halls must be delayed until 9:00 a.m. Daily sign-in logs must be maintained by the contractor. Week-end work must be scheduled in advance and each contractor must log in and out with security.
4. Reserved.
5. All work areas are to be sufficiently barricaded off to prevent access by unauthorized personnel. Signs shall also be posted as necessary.
6. All temporary utilities should be arranged prior to start of work.
7. All work areas are to be cleaned/restored to their original condition. All damaged areas are to be repaired prior to final payment.
8. No safety equipment or utilities (fire alarms, water, electricity, etc.) can be disabled without prior minimum 72-hour notice to the Facilities Management Office.
9. No radios are allowed on-site unless approved in advance.
10. No chemicals, paint, or other waste materials are to be disposed of down the drains or on campus property. All laws and regulations regarding hazardous communication must be observed. MSDS shall be available at all times. UNE maintains a complete set of MSDS for potential chemical hazards in the Security Office. Please inform all subs and suppliers.
11. Any injury requiring medical attention must be reported to UNE Facilities Management Office within 8 hours.
12. The Universities policy on Alcohol and Drug use applies to all contractors. Alcohol/drug possession or use will result in immediate removal of the contract firm as well as the individual. No other warnings will be given.
13. All work must be done in compliance with the ADA act 504. Any work that does not meet this will be modified at no cost to the university.

14. The University is a non-profit entity. This means **we are tax-exempt**, therefore we will not pay any sales tax of any kind for labor or materials provided to the University. The University's tax exempt number is E-10129.

If there are any questions regarding the above information, call the Facilities management Office at (207) 283-0170 ext. 2368.

SECTION 011100 - SUMMARY OF THE WORK

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and project manual of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 PROJECT DESCRIPTION

- A. This project consists of the renovation of Goddard Hall and site work.
 - 1. This project is broken into to two phases. Phase One is the renovation of the exterior shell including vertical circulation. Phase Two is the interior fitout of the various floors.

Phase One consists of the gutting on the interior of Goddard Hall's existing four floors completely and the re-insertion of a structural steel frame and concrete on metal deck floors in stages. The exterior of the building is to remain except for the cleaning and repointing of the exterior brick façade, the replacement of the existing windows, an EPDM roof and an entry with a new path consisting of a brick retaining wall and pavers. Two stair towers and a five-stop elevator with masonry shafts will be added. The masonry shafts will act as structural lateral reinforcement. The work includes all associated mechanical, electrical, plumbing and structural elements as required for infrastructure. Civil work includes the upgrading of existing sewer and drainage systems.

Phase Two consists of fitout of the four floors and will consist of interior finishes which includes gypsum walls, carpet (both rolled goods and tile), VCT, ceramic tile, barrowed lights, and millwork. The work includes all associated mechanical, electrical, and plumbing.

1.3 CONTRACTOR USE OF PREMISES

- A. General: Limit use of the premises to construction activities in areas indicated.
- B. The contractor is to furnish for review prior to start of work, a Construction Schedule of Work and Sequencing of Operation with dates and monetary values in coordination with the date of completion.

1.4 OWNER OCCUPANCY

- A. Occupancy: not be occupied but the buildings around it will be occupied.

END OF SECTION

SECTION 012300 - ALTERNATES

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. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

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

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Rust Remover Application.
- B. Alternate No. 2: Provide copper roof at existing entry canopy. See drawings.

END OF SECTION 012300

SECTION 012900 - 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. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals 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.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. 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.
 - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the 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. Submit draft of AIA Document G703 Continuation Sheets.
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.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. If specified, include evidence of insurance or bonded warehousing.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- 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. Payment Application Times: Progress payments shall be submitted to Architect as agreed upon by the Architect, Owner, and Contractor. The period covered by each Application for Payment is one month, ending on the date indicated on the contract and monthly thereafter.
- D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- E. 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager 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 liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 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 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 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 waivers of lien on forms, executed in a manner 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.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
 16. Initial settlement survey and damage report if required.
- I. Application for Payment at Substantial Completion: After issuing 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.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. 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.
 9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - 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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Section include the following:
 - 1. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- 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.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- C. 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.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and 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.
 9. Project closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.

- c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
 3. Number of Copies: Submit five opaque copies of each submittal. Architect will return three copies.
 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- 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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 1. Include special personnel required for coordination of operations with other contractors.

1.7 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: 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 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. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All 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. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
 3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires 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 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. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.

- i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. 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 parties who should have been present.
 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.
- D. Progress Meetings: Conduct progress meetings at weekly intervals unless otherwise agreed upon. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. 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) 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 correction of deficient items.
 - 14) Field observations.
 - 15) RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
3. Minutes: Record the meeting minutes.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - 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.
- E. Coordination Meetings: Conduct Project coordination meetings at weekly 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 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 conference 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) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned 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 interpretation and the following:
 1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

- a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: CSI Form 13.2A.
1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 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 according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- 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.
- G. 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 dropped and not submitted.
 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.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - 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. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Submittals Schedule.
 - 4. Daily construction reports.
 - 5. Field condition reports.
 - 6. Special reports.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
 - 2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.

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 activities are activities on the critical path. They 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 is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 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. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- H. Major Area: A story of construction, a separate building, or a similar significant construction element.
- I. Milestone: A key or critical point in time for reference or measurement.
- J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

- A. Qualification Data: For scheduling consultant.
- B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.
- C. Preliminary Construction Schedule: Submit three opaque copies.
 - 1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.
- D. Contractor's Construction Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated 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. Daily Construction Reports: Keep on site for review from client, contractor or other design staff if requested.
- G. Material Location Reports: Submit two copies at monthly intervals.
- H. Field Condition Reports: Keep on site for review from client, contractor or other design staff if requested.
- I. Special Reports: Submit two copies at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "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 phasing, work stages, area separations, interim milestones and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review time required for review of submittals and resubmittals.
 6. Review requirements for tests and inspections by independent testing and inspecting agencies.
 7. Review time required for completion and startup procedures.
 8. Review and finalize list of construction activities to be included in schedule.
 9. Review submittal requirements and procedures.
 10. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for current date to date of Final Completion. Please include any items that might effect construction timeline.
 - 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 principal 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. 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.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 4. Startup and Testing Time: Include not less than required days for startup and testing.
 5. 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.
- 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. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.

7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- 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. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
 1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
 2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 3. Each activity cost shall reflect an accurate value subject to approval by Architect.
 4. Total cost assigned to activities shall equal the total Contract Sum.
- G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Preliminary Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 60 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 computerized, 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 30 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. Include list of nonworking days and holidays incorporated into the schedule.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary 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.
 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.
- E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Principal 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).
- F. 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.
- G. 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.

2.4 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.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (refer to special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial Completions and occupancies.
 19. 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.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. 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 Actual Completion percentage for each activity.
- B. 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.

END OF SECTION 013200

SECTION 013300 - 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. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
 - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
 - 4. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 5. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 6. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
- 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. 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. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough 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 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 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 indicated, allow 21 days for initial review of each submittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 4 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.

- F. Deviations: Highlight, encircle or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review received from sources other than Contractor.
1. Transmittal Form: Use AIA Document G810.
 2. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 3. 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 label information as related submittal.
- I. 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 "Reviewed" or "Approved as noted."
- J. 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.
- K. Use for Construction: Use only final submittals with mark indicating "Reviewed" or "Approved as noted" taken by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Submit all submittals digitally through email.
- B. 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 printed 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 written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Number of Copies: Submit one electronic copy of Product Data, unless otherwise indicated. Architect will return one electronic copy.
- C. 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.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.

- i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
 3. Number of Copies: Submit five opaque (bond) copies of each submittal. Architect will return three copies. For structural submittal, provide two copies (one reproducible).
- D. 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. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
 3. 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.
 4. 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.
 5. 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 one set of Samples. Architect will retain Sample sets.
 - 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.
- E. Product Schedule or List: 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.
 2. Number and name of room or space.
 3. Location within room or space.
 4. Number of Copies: Submit four copies of product schedule or list, unless otherwise indicated. Architect will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.
- G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- J. 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.
 4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copy.
 - a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit one electronic copy of each submittal, unless otherwise indicated. Architect will not return copies.
 - 2. Certificates and Certifications: Provide a notarized 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.
 - 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare 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.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare 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.
- K. Product Test Reports: Prepare written reports indicating 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.

- L. Research/Evaluation Reports: Prepare 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:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- N. Preconstruction Test Reports: Prepare 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.
- O. Compatibility Test Reports: Prepare 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.
- P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.
- Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- R. Design Data: Prepare 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.
- S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.

- T. **Manufacturer's Field Reports:** Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service 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.
- U. **Insurance Certificates and Bonds:** Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- V. **Material Safety Data Sheets (MSDSs):** Submit information directly to Owner; do not submit to Architect.
1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

- 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. 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. **Approval Stamp:** Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ARCHITECT'S / ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. Reviewed, Furnish as Corrected, Rejected, Revise and Resubmit, and Submit Specific Item.
- C. 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.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- F. Architect will return one electronic copy of the submittal and post all reviewed submittals on to the Architect's website. Website instructions will be provided once submittals have been posted.

END OF SECTION 013300

SECTION 014000 - 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. This 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, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. 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.
- B. 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. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. 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, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision 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.

1.5 SUBMITTALS

- A. **Qualification Data:** 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.
- B. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Description of test and inspection.
 3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- C. **Reports:** Prepare and submit certified written reports that 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 reinspecting.
- D. **Permits, Licenses, and Certificates:** For Owner's records, 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.

1.6 QUALITY ASSURANCE

- A. **General:** Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **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.

- C. **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.
- D. **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.
- 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 to those indicated for this Project in material, design, and extent.
- F. **Specialists:** Certain sections of the Specifications 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. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- 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 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. **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.
- I. **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:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

- f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, 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.

1.7 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. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. 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, and the Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. 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.
 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. 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 Division 01 Section "Submittal Procedures."
- D. 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.

- E. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, 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.
- F. Associated Services: Cooperate with agencies 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.
- G. 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.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 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:

- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, 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, 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. 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 modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

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. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- 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 014000

SECTION 014200 - 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," "approved," "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": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- 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.
- 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.
- D. **Abbreviations and Acronyms for 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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl1

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA)	
	Accessibility Guidelines for Buildings and Facilities	(202) 272-0080
	Available from Access Board www.access-board.gov	
CFR	Code of Federal Regulations	(888) 293-6498
	Available from Government Printing Office	(202) 512-1530
	www.gpoaccess.gov/cfr/index.html	
CRD	Handbook for Concrete and Cement	(601) 634-2355
	Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	
DOD	Department of Defense Military Specifications and Standards	(215) 697-6257
	Available from Department of Defense Single Stock Point www.dodssp.daps.mil	
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification	(215) 697-

		6257
	Available from Department of Defense Single Stock Point www.dodssp.daps.mil	
	Available from General Services Administration www.fss.gsa.gov	(202) 501-1021
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dodssp.daps.mil	(215) 697-6257
NES	(Formerly: National Evaluation Service) (See ICC-ES)	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

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 Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- 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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl2

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The)	(800) 242-3837

	www.aia.org	(202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722

ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(334) 874-9800
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(773) 761-4100
	Cast Stone Institute www.caststone.org	(770) 972-3011
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CDA	Copper Development Association Inc.	(800) 232-3282

	www.copper.org	(212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca/connections_online/home.htm	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CGSB	Canadian General Standards Board w3.pwgsc.gc.ca/cgsb	(800) 665-2472 (819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087

DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.asce.org	(800) 548-2723 (703) 295-6300
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FCI	Fluid Controls Institute www.fluidcontrolsintitute.org	(216) 241-7333
FIBA	Federation Internationale de Basketball Amateur (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM	Factory Mutual System (Now FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	52 951 5146905
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America	(785) 271-0208

	www.glasswebsite.com	
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation www.intbadfed.org	441-24 223-4904
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510

ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(702) 567-8150
ITS	Intertek www.intertek.com	(800) 345-3851 (607) 753-6711
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers	(312) 332-0405

	www.naamm.org	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193 ext. 453
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association)	(800) 344-3555 (617) 770-3000

	www.nfpa.org	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. www.opl.com	(800) 966-5253 (210) 635-8100
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720

PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
RTI	(Formerly: NTRMA - National Tile Roofing Manufacturers Association) (Now TRI)	
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI	Structural Engineering Institute www.seinstitute.com	(800) 548-2723 (703) 295-6195
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	(703) 803-2980

	www.smacna.org	
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/ SPFD	Society of the Plastics Industry, Inc. (The) Spray Polyurethane Foam Division (Now SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 705-9898

TRI	Tile Roofing Institute (Formerly: RTI - Roof Tile Institute) www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(800) 285-4476 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 548-0112

WWPA Western Wood Products Association (503) 224-3930
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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl3

BOCA BOCA International, Inc.
(See ICC)

CABO Council of American Building Officials
(See ICC)

IAPMO International Association of Plumbing and Mechanical Officials (909) 472-4100
www.iapmo.org

ICBO International Conference of Building Officials
(See ICC)

ICBO ES ICBO Evaluation Service, Inc.
(See ICC-ES)

ICC International Code Council (703) 931-4533
(Formerly: CABO - Council of American Building Officials)
www.iccsafe.org

ICC-ES ICC Evaluation Service, Inc. (800) 423-6587
www.icc-es.org (562) 699-0543

NES National Evaluation Service
(See ICC-ES)

SBCCI Southern Building Code Congress International, Inc.
(See ICC)

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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl4

CE Army Corps of Engineers
www.usace.army.mil

CPSC Consumer Product Safety Commission (800) 638-2772
www.cpsc.gov (301) 504-6816

DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense www.dodssp.daps.mil	(215) 697-6257
DOE	Department of Energy www.eren.doe.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 501-1888
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science http://phs.os.dhhs.gov	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000

TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- E. 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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PRIVATE tbl5

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Products Laboratory http://txforests-service.tamu.edu	(936) 639-8180

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 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.

1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall 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 (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.
- B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.
- C. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- D. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."
- E. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- F. 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.
- G. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: 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 construction personnel. 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 is required.
 3. Drinking water.
 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. 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.
1. General Contractor and Owner to agree on location of trailer(s).
- 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 Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 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.

PART 3 - EXECUTION

3.1 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.
- 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.

3.2 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: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Use of Owner's existing water service 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.
1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- F. Heating: Provide temporary heating 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.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Connect temporary service to Owner's existing power source, as directed by Owner.
- J. 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.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 2. At each telephone, post a list of important telephone numbers.

- a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- L. WiFi: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
 2. Maintain support facilities until near Substantial Completion. 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. 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.
- D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- E. 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 nor endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
 - H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
 - I. 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.
 - J. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.
 - K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
 - L. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that 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 Division 01 Section "Summary."
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Comply with requirements specified in Division 01 Section "Temporary Tree and Plant Protection."
- 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. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. 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 not complete, insulate temporary enclosures.
- I. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied and previously finished by Owner from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 - 2. Construct dustproof partitions with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - 3. Insulate partitions to provide noise protection to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 5. Protect air-handling equipment.
 - 6. Weather strip openings.
 - 7. Provide walk-off mats at each entrance through temporary partition.
- J. 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.
 - 1. Smoking is not permitted in the buildings.
 - 2. Prohibit smoking in construction areas.
 - 3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 4. 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.
 - 5. 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.

3.5 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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. 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 paving not intended for or acceptable for integration into permanent paving. 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, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - 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. This 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; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased 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, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 5 copies of initial product list (for structural provide (2) copies and (1) one reproducible. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify 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 CSI Form 13.1A.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as

- performance, weight, size, durability, visual effect, and specific features and requirements indicated.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. 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 lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. 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 7 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 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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. 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 ensure compliance with the Contract Documents and to ensure 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. Store cementitious products and materials on elevated platforms.
 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 7. Protect stored products from damage and liquids from freezing.
 8. 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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final 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 appropriate form properly executed.
 3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.

3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified 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 provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: 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.

- B. 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:
1. 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.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
 10. 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.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product 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:
1. Evidence that the proposed product does not require extensive 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - 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. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

- B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor.
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: 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 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; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. 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 Owner 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, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. 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 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: 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 8 feet (2.4 m) in spaces without a suspended ceiling.
- 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. 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.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 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.
- H. 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.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 - 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 forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- 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: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- 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.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 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. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017329 - CUTTING AND PATCHING

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. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 2. Division 07 Section "Penetration Firestopping" for patching 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 surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least two (2) days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. 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. Operating elements include the following:
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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. Miscellaneous elements include the following:
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. 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.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. 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 minimize interruption to occupied areas.

3.3 PERFORMANCE

- A. 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. 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 as small as possible, neatly to 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 Division 31 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.
- C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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 eliminate 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, apply primer and intermediate paint coats 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.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017700 - 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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 2. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 11. Advise Owner of changeover in heat and other utilities.
 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 13. Complete final cleaning requirements, including touchup painting.
 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. 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.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. 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.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies 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.
 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.

1.6 WARRANTIES

- A. Submittal Time: 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.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- 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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide 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 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. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.

- l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to unusual operating conditions.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - s. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 - 3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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 SUBMITTALS

- A. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. 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.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 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."

2.2 MANUALS, GENERAL

- A. Organization: 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: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
 - 6. Name and address of Architect.
 - 7. 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.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

- A. 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.
 2. Performance and design criteria if Contractor is 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.
- B. Descriptions: Include the following:
 1. Product name and model number.
 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.
- C. 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.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. 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 warranty and bond information, as described below.

- B. **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.
- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 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.
- D. **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 videotape, if available.
- E. **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.
- F. **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.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. **Operation and Maintenance Documentation Directory:** Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

- B. 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.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 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.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.
 - 1. 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.
- F. 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 operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 017839

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Submit one set(s) of marked-up Record Prints
 - 1) Electronic Media: One PDF copy, CD-R.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 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 prepare the 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 understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
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 or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 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. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.2 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. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. 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.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Each subcontractor shall keep track of field conditions daily, and record changes on record set kept at Design-Builder's job trailer. Record documents shall be maintained and current with each subcontractor's application of payment.
- C. Maintenance of Record Documents and Samples: Store Record Documents and Samples 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 for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. This 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 videotapes.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Management and Coordination" for requirements for preinstruction conferences.
 - 2. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- 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.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - 1. HVAC systems, including instrumentation and controls.
 - 2. HVAC instrumentation and controls.
 - 3. Electrical service and distribution, including switchboards, and panelboards.
 - 4. Lighting equipment and controls.
 - 5. Communication systems, including voice and data equipment.
- B. Training: Develop a learning objective and teaching outline. Include instruction as applicable for the following:
 - 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

- A. Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. 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 with at least fourteen days' advance notice.

3.03 DEMONSTRATION AND TRAINING VIDEO

- A. General: Provide manufacturer's standard prepared training videos, if available..

END OF SECTION 01820

SECTION 03 30 00 – CAST -IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of 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 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 DESCRIPTION OF WORK:

- A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:
 - 1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.
 - 2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.
 - 3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

1.03 RELATED WORK:

- A. Metal Fabrications: Section 05 50 00
 - 1. Expansion Anchors - Section 05 12 00
 - 2. Embedded Items - Section 05 50 00
- B. Anchor Bolts: Section 05 12 00
- C. Shotcrete: Section 03 37 13
- D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI "Manual of Concrete Practice".
 2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
 3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
 4. ACI 212.3R "Chemical Admixtures for Concrete."
 5. ACI 301 "Specifications for Structural Concrete for Buildings."
 6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
 7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
 8. ACI 304.2R "Placing Concrete by Pumping Methods."
 9. ACI 306 R "Cold Weather Concreting."
 10. ACI 308 "Standard Practice for Curing Concrete."
 11. ACI 309R "Guide for Consolidation of Concrete."
 12. ACI 315 "ACI Detailing Manual."
 13. ACI 318 "Building Code Requirements for Reinforced Concrete."
 14. ACI 347R "Guide to Formwork for Concrete."
 15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
 16. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 17. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

1.05 SUBMITTALS:

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.

- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
 - 1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
 - 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
 - 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
 - 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
 - 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - 1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.
 - 2. Patching products.

3. Non-shrink grout.
 4. Curing compounds, where applicable.
 5. Admixtures.
 6. Expansion/Adhesive Anchors.
- J. Shop Drawings:
1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.
 - a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
 - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**
- K. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.
- L. LEED Documentation: Refer to paragraph 1.06 of this section and Section 01352.
- M. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.
- N. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.
- O. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.
- P. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

1.06 LEED Requirements

A. Material Recycled Content: Slag or Fly Ash Cement Replacement

1. Blast Furnace Slag: Granulated blast furnace slag conforming to ASTM C989, included in the calculation of water-cementitious materials, and shall be included in the concrete mix. The weight of granulated blast-furnace slag shall be 40 percent of cementitious materials. The slag used in the manufacture of a Type IS or ISM blended hydraulic cement conforming to ASTM C595 shall be included in the calculated percentage.
2. Fly Ash: As an alternate to Blast Furnace Slag, Fly Ash and pozzolan conforming to ASTM C618, included in the calculation of water-cementitious materials, shall be included in the concrete mix. If used the Fly ash shall be included in the percentages prescribed above. The fly ash and pozzolan present in ASTM Type IP or IPM blended cement, conforming to ASTM C595, shall be included in the calculated percentage.
3. Concrete mix designs shall indicate the cement replacement percentages.
4. Substitution of 4,000 psi concrete for 3,000 psi concrete is not acceptable.

B. Material Recycled Content: Concrete Reinforcing Steel

1. The sum of the post-consumer and half pre-consumer recycled content: 60% minimum
2. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

C. Local/Regional Materials: Ready-mix concrete supplier shall be located within 500 miles of the project location. In addition, all ingredients within the concrete mix shall be extracted, harvested or recovered within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials.

D. Low emitting adhesives and sealants: Provide water-based, biodegradable form coating with maximum VOC content of 55 grams/liter. Provide cut sheet and/or material safety data sheet for form coating with VOC levels highlighted.

E. Waste Management:

1. Before concrete pours, designate locations or uses for excess concrete. Options include the following:
 - a. Additional paving.
 - b. Post footing anchorage.
 - c. Swale, riprap reinforcing.
 - d. Flowable fill.
 - e. Footing bottom, retaining wall footing ballast.

- f. Storm structure covers.
 - g. Underground utility pipe kickers.
 - h. Storm pipe flared end section.
 - i. Toe wash protection, and shoulder and toe outfall restraints for temporary erosion pipes.
2. Before concrete pours, designate a location for cleaning out concrete trucks. Options include the following:
- a. Company-owned site for that purpose (meeting environmental standards).
 - b. On-site area to be paved later in Project.
3. Collect waste reinforcing steel and place in designated area for recycling.

PART 2 PRODUCTS

2.01 FORM MATERIALS:

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
- 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS:

- A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.
- B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.
- C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.
- D. Light Weight Aggregates: ASTM C 330.
- E. Water: Potable.
- F. Air-Entraining Admixture: ASTM C 260.
- G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.
- H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.
- I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.
- J. Accelerating Admixture: ASTM C 494, Type C or E.
- K. Blast Furnace Slag: ASTM C989
- L. Fly Ash: ASTM C618, Class C or F
- M. Calcium Chloride is not permitted.

2.04 RELATED MATERIALS:

- A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.
- B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.

1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with CRD-C-621.
 2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when tested in accordance with ASTM C-109.
 3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.
 4. Composition: Shall not contain metallic particles or expansive cement.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
- D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.
1. Waterproof paper.
 2. Polyethylene film.
 3. Polyethylene-coated burlap.
- E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.
- F. Preformed Expansion Joint Formers:
1. Bituminous Fiber Type, ASTM D 1751.
 2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.
- G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).
- H. Waterstops shall be Bentonite/Butyl Rubberbased product. Use in conjunction with manufacturer's approved mastic. Acceptable products include:
1. "Waterstop Rx," by American Colloid Co.
 2. "Adeka Ultra Seal MC-2010," by Asahi Denka Kogyo, Kik MN.

2.05 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

- B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.
- C. Proportion design mixes to provide concrete with the following properties:
1. Footings and foundation walls
 - a. Strength: 3000 psi at 28 days.
 - b. Aggregate: 3/4"
 - c. W/C Ratio: 0.54 maximum
 - d. Entrained Air: 6% +/- 1.5%
 - e. Slump: 4" maximum
 2. Interior Slabs on grade and elevated slabs:
 - a. Strength: 3000 psi at 28 days
 - b. Aggregate: 3/4" minimum, 1 1/2" maximum.
 - c. W/C Ratio: 0.54 maximum
 - d. Entrapped Air only (no entrainment), 2.5% +/- 1%
 - e. Slump: 4" maximum
 3. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:
 - a. Strength: 4500 psi at 28 days
 - b. Aggregate: 3/4"
 - c. W/C Ratio: 0.45 maximum
 - d. Entrained Air: 6% +/- 1.5%
 - e. Slump: 4" maximum
 4. Add air entraining admixture at manufacturers prescribed rate to result in concrete at point of placement having the above noted air contents.
 5. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.

1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.
2. Additional dosages of superplasticizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

2.06 CONCRETE MIXING:

- A. Job-Site Mixing will not be permitted.
- B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.
 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.
 2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS:

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.

- F. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- G. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
 - 1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.
 - 2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.
- I. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. 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. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Subgrade tolerance shall conform to a tolerance of $+0/-1 \frac{1}{2}$ ". Base tolerance (fine grading) for slabs shall conform to a tolerance of $+0"/-3/4$ " in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.
 - 2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
 - 3. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
 - 4. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

5. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS:

- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.
 1. Provide keyways at least 1-1/2" deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.
 2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.
 3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
 4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

3.04 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set and build into work anchorage devices and other embedded items (including reinforcement and reinforcing dowels) required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete. “Wet Setting” of embedded items into plastic concrete will not be permitted without special permission from the Engineer.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.
- C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.
- D. Tolerances: Tolerances for Anchor Bolts/Rods, other embedded items and bearing surfaces shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction “Code of Standard Practice for Steel Buildings and Bridges,” and ACI 117. The more stringent criteria from these documents shall apply.

3.05 INSTALLATION OF GROUT

- A. Place grout for base plates in accordance with manufacturer's recommendations.

- B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.
- C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

3.06 PREPARATION OF FORM SURFACES:

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 CONCRETE PLACEMENT:

- A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.
- B. Concrete shall be placed in the presence of an approved testing agency.
- C. General: Comply with ACI 304, and as herein specified.
 - 1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
 - 2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
 - 3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

- a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
 - b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
 - c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.
 - d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.
 - e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.
4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
 2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.
 3. Maintain reinforcing in proper position during concrete placement operations.
 4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.
 5. Finish: See "Monolithic Slab Finishes" in this specification for slab finish requirements.
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.
 4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost , freezing action, or low temperature shall be provided prior to start of placing operations.
 5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.
- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Wet forms thoroughly before placing concrete.
4. Do not use retarding admixtures without the written acceptance by the Architect.

3.08 FINISH OF FORMED SURFACES:

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This as-cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
 1. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off, smooth and finish with a texture matching adjacent unformed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FLOOR FLATNESS AND LEVELNESS

- A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for "flat" floor profile.
 1. Minimum Test Area Flatness/Levelness: F_F35/F_L25
 2. Minimum Local F Number: F_F25/F_L15
- B. Levelness criteria shall be applied to slabs-on-grade only.
- C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

3.10 MONOLITHIC SLAB FINISHES:

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.
 - 1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.
- D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
- E. Slab finishes for floor coverings not indicated or exposed to view in the final condition shall be coordinated with the Architect prior to slab placement.
- F. Slab Joints: Where indicated, sawn slab contraction joints shall be "soft cut", immediately after concrete surface is firm enough not to be torn or damaged by the blade.

3.11 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage. Slabs-on-grade shall be cured by "wet" curing methods unless otherwise noted; Slabs-on-grade to receive floor coverings with moisture sensitive adhesives shall be cured by means of a moisture retaining covering. Coordinate curing with flooring adhesive manufacturer and flooring installer. Submit curing methods to Architect for review and approval.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- D. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

3.12 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

3.13 REUSE OF FORMS:

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.14 MISCELLANEOUS CONCRETE ITEMS:

- A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.15 CONCRETE SURFACE REPAIRS:

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.
 - 1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with approved bonding agent. Place patching mortar after bonding compound has dried.
 - 2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. Testing Agency/Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Agent shall verify WWF or reinforcement has been chair/placed with proper clearances.
- B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.
- C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.
- D. See Submittals section for report requirements.
- E. Sampling Fresh Concrete: ASTM C 172.
 - 1. Slump: ASTM C143; One test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.
 - 2. Air Content: ASTM C231 "Pressure method for normal weight concrete." one test for each set of compressive strength specimens measured at point of discharge.
 - 3. Concrete Temperature: Per ASTM C-1064; one test each time a set of compression test specimens are made.
 - 4. Compression Test Specimen: ASTM C31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
 - a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.
 - b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.
 - c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.

- d. Test Specimens shall be moist cured.
 - e. Refer to ACI C31 for additional requirements for Test Specimens.
5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 specimen tested at 56 days, 1 specimen retained in reserve for later testing if required.
6. Pumped concrete shall be tested at point of discharge per ACI 301.
- F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 37 13 – SHOTCRETE

1. SCOPE

The work shall consist of furnishing, mixing, applying and curing shotcrete. Except as otherwise specified, either a dry mix or wet mix process may be used.

2. MATERIALS

Portland cement shall conform to the requirements of Section 03 30 00 for the specified type.

Aggregates shall conform to the requirements of Section 03 30 00 unless otherwise specified. Gradation shall be one of the three options specified by ACI 506R, Table 2.1 unless otherwise specified.

Admixtures, if specified, shall meet the requirements indicated. Non-chloride chemical admixtures shall conform to ASTM C 494. Air-entraining admixtures shall conform to ASTM C 260. Fly ash or pozzolanic materials shall conform to ASTM C 618. Calcium chloride shall conform to ASTM D 98 and shall be in flake or pellet form.

Water used in mixing or curing shotcrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Curing compound shall conform to the requirement of Section 03 30 00.

3. STRENGTH AND QUALITY

The compressive strength of shotcrete at the age of 28 days shall be not less than 3000 psi.

Shotcrete shall be uniform and dense, free from "drummy" areas that indicate laminations, voids, sand pockets, or disbanded material.

4. CONSISTENCY

The proportion of water added to the mixture shall be accurately controlled to produce thorough and uniform hydration of the shotcrete. The consistency of the shotcrete shall be such that the surface of the shotcrete in place shall have a rich, glossy appearance and that the shotcrete shall adhere to the supporting surface without flowing, slumping or sloughing. For application to vertical or overhanging surfaces the mix proportions shall be adjusted so that the placed shotcrete will adhere to a minimum thickness of 3/4-inch without sagging or sloughing. For adjustment of consistency the addition of fly ash or pozzolanic material to the mixture in amounts not greater than 20-percent (by weight) of cement in the mixture will be permitted.

5. INSPECTION AND TESTING

Procedures for preparing shotcrete test panels and the testing specimens sawed or cored from panels will be performed in accordance with ASTM Method C 1140. The compression test specimens will be cores taken from the test panels or from the structure.

Similar panels not less than 18 inches square and not less than six (6) inches thick shall be made periodically as directed by the Engineer during the progress of the work.

Cores, taken from the test panels, shall receive standard curing in lime-saturated water at 73.4° +/- 3.0° F within 24 hours after removal. Cores shall continue to receive the prescribed initial cure treatment until standard curing is commenced.

For each strength test, three (3) cores will be tested in compression. The test result will be the average of the strengths of the three (3) specimens, except that if one specimen shows manifest evidence of improper sampling, coring, or testing, it will be discarded and the strengths of the remaining two (2) specimens will be averaged. If more than one (1) specimen representing a test shows such defects, the entire test will be discarded.

The Contractor shall furnish the forms and make the required test panels and shall provide such facilities, materials and assistance as may be necessary for curing, handling, and protecting the panels. Test panels shall be cast only when the Engineer is present.

6. NOZZLE OPERATOR QUALIFICATIONS

The nozzle operator shall be able to document a minimum of 3000 hours of experience as a nozzle operator and shall have completed at least one (1) similar application as a nozzle operator, unless otherwise specified.

The nozzle operator and application crew members shall be required to meet pre-construction testing requirements administered by the Engineer on a test panel or an area as follows:

The Engineer will carefully observe shooting of the test panel or area and note if the nozzle operator examinee:

- a. Cleans the shooting surface with air and water prior to shooting.
- b. Applies a bonding coat on the shooting surface ahead of the heavier shotcrete applications.
- c. Directs shotcrete application around reinforcement in a manner which prevents buildup on the face of the reinforcement and allows the shotcrete to flow and compact tightly around the back of the reinforcement.
- d. If applicable, directs the finisher or nozzle helper to cutout any sags, sand or rebound pockets.
- e. If applicable, and where necessary, directs the finisher or nozzle helper to broom the shotcrete surface prior to application of additional layers.

7. MEASURING MATERIALS

The proportions of the shotcrete mix shall be controlled on the basis of the weight of each component material, unless otherwise specified in Section 19 of this specification, except that water may be measured by volume. Materials shall have the following batch tolerances of their mix proportion weights: Cement, plus or minus two (2) percent; Aggregate, plus or minus four (4) percent; Admixtures, plus or minus six (6) percent. Weighing equipment used shall be accurate to within 0.4 percent of scale capacity.

8. EQUIPMENT

The Contractor shall furnish all equipment necessary for batching, mixing and placing the shotcrete. The equipment shall meet the following requirements.

The placing equipment for dry mix shotcrete shall be designed and equipped to receive the dry mix, introduce the mix into a stream of compressed oil free dry air, convey the mix pneumatically through a delivery hose to a nozzle at the point of discharge, inject water under pressure into the suspended stream of dry sand and cement within the nozzle, and spray the resulting shotcrete mix onto the surface of the work at a uniform rate and at a controlled velocity. The placing equipment shall be equipped with accurate gauges to indicate the air pressure and water pressure and with devices capable of accurately controlling the air

pressure at any level between 50-psi and 80-psi, the water pressure at any level between 50-psi and 100-psi, and the rate of application of water at the nozzle.

The placing equipment for wet mix shotcrete shall be designed and equipped to receive the shotcrete from the mixer, convey it through a delivery hose to a nozzle at the point of discharge, accelerate it in the nozzle by means of compressed oil free dry air, and spray it onto the surface of the work. It shall be capable of delivering shotcrete to the nozzle uniformly and continuously and discharging it from the nozzle at a uniform rate and at a controlled velocity sufficient for all parts of the work.

Batch and continuous mixing equipment shall include: a power-driven mixer capable of thoroughly mixing the materials at a rate adequate to insure uniform feeding of the mixture to the placing equipment; and a feeding apparatus capable of supplying the mixture to the placing equipment at an adequate and uniform rate.

9. MIXING

Dry Mix Shotcrete The cement and admixtures and other additives (except accelerator) shall be mixed into a predampened homogeneous mass that thoroughly coats the aggregate before being fed through a vibratory screen into the placing equipment. Proper pre-dampening shall be indicated by the "ball-in-hand" test as follows: When a small amount of mix is tightly squeezed the resulting ball will hold together or crack slightly but essentially remain whole. The mix has too little pre-dampening moisture if the ball crumbles into discrete particles when the hand is opened and/or color is light gray. If moisture comes off on the hand, too much pre-dampening moisture is in the mix. The properly pre-dampened dry mix shall be used within 45 minutes after mixing (15 minutes in hot weather conditions with temperatures over 85° F) and any material that becomes dried out or caked after mixing shall be wasted. Rebound material shall not be remixed or reused.

Wet Mix Shotcrete Air-entrainment and chemical admixtures may only be used in wet mix concrete. The cement, sand, admixtures (except accelerator) and water shall be thoroughly mixed in the mixer drum sufficiently to produce shotcrete of the required consistency that is uniform within each batch and uniform from batch to batch when discharged into the placing equipment.

Accelerators, if specified, shall be mixed at the nozzle. Ready-mix concrete shall conform to the requirements of ASTM C 94 unless otherwise specified.

The entire contents of the mixer shall be discharged from the drum before materials for a succeeding batch are placed therein. A mix that becomes difficult to pump shall be discarded; otherwise, a batch shall be gunned within 1 1/2 hours of batching in normal weather and within 45 minutes during hot weather conditions (temperatures over 85° F). Rebound material shall not be remixed or reused.

10. FORMS

Forms shall be structurally adequate and of such design that rebound or accumulated loose sand can freely escape or be readily removed. Shooting strips shall be used at corners, edges, and on surfaces where necessary to obtain true lines and proper thickness. Where practicable, ground wires shall be installed as guides to accurately establish the specified contour of the finished surface of shotcrete. Ground wires shall be set and used as guides for templates in forming curved and molded surfaces. When shotcrete is to be placed on horizontal or sloping surfaces, headers and ground wires shall be provided to the extent necessary to insure control of slab thickness. Ground wires shall be tightened and kept taut, secure, and true to line and plane during placement of shotcrete and shall be removed when placement is completed.

Header boards will be required where the drawings indicate a square edge and at required joints. Form surfaces shall be thoroughly cleaned and a form release agent applied before shotcrete is placed.

11. PREPARATION OF SURFACES TO RECEIVE SHOTCRETE

All surfaces to receive or support shotcrete shall be carefully prepared and conditioned. All such prepared surfaces shall be inspected and approved by the Engineer prior to the application of shotcrete.

Earth surfaces to which shotcrete is to be applied shall be firmly compacted and neatly trimmed to line and grade.

Asphaltic concrete surfaces shall be thoroughly cleaned of any growths, earth, or any other material that would affect bond, or be detrimental to the shotcrete.

Concrete, mortar, or rock surfaces shall be thoroughly cleaned by water blasting or sand blasting to remove all dirt, laitance, weak or unbonded mortar, loose material, grease or other deleterious substances.

Surfaces on which the shotcrete is to be placed shall be sufficiently rough to insure the adherence of the shotcrete. Offsets which would cause an abrupt and substantial change in thickness of the shotcrete shall be removed or tapered.

All surfaces shall be maintained in a moistened condition for three (3) hours before application of shotcrete. Shotcrete shall not be applied to mud, dried earth, uncompacted fill, rebound material, or surfaces on which free water exists unless otherwise specified in Section 19. All ice, snow and frost shall be removed and the temperature of all surfaces, to be in contact with the new shotcrete shall be no colder than 40° F.

12. PLACING

The Contractor shall have all equipment and materials required for curing available at the site and ready for use before placement of shotcrete begins. No shotcrete shall be placed except in the presence of the Engineer or authorized representative. The Contractor shall give reasonable notice to the Engineer each time shotcrete placement is scheduled. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the surfaces to which the shotcrete is to be applied, the forms, steel reinforcement, and other preparations for compliance with the specifications prior to the start of placement operations.

During placement of shotcrete the air pressure shall be adjusted as required to control rebound and density of shotcrete. For a given application, once the optimum operating pressures have been established they shall be maintained constant throughout the application. For dry mix shotcrete, the air pressure at the material outlet or air-inlet on the gun shall be not less than 40 psi plus 5 psi for each 50 feet of length of the discharge hose greater than 100 feet and 5 psi for each 25 feet the nozzle is above the gun (shotcrete delivery equipment). The water pressure at the nozzle shall be not less than 15 psi greater than the air pressure at the material outlet or air-inlet on the gun.

For most applications the placing nozzle shall be held between two (2) and six (6) feet from and approximately normal to the surface of the work. At longer distances it may be necessary to increase the nozzle velocity so that the impact velocity will suit the requirements of the application. Corners shall be filled first.

Shotcrete shall be applied in a single thickness or to a layer thickness no greater than that which will cause sagging, sloughing, or dropout. Sags and sloughs shall be cut out and regunned. Replacement shall be accomplished before the previously placed shotcrete has

completely set. When shotcrete is placed on a vertical surface, application shall be started at the bottom and be completed at the top.

In any case when the placing of shotcrete is interrupted for more than one (1) hour, the edge of the layer shall be sloped off at an angle of approximately 45 degrees to the surface being shot, and the sloped portion shall be covered with a double layer of six (6) ounce burlap and kept continuously moist until the application of shotcrete is resumed. Before applying new material, the sloped portion shall be thoroughly cleaned and wetted by means of an air and water blast or an equally effective method approved by the Engineer.

Material that rebounds and accumulates on forms, subgrade surfaces or reinforcing steel ahead of the shotcrete being placed shall be removed and discarded.

13. FINISHING

Rebound material shall be carefully swept off the finished shotcrete surface and discarded before it becomes too hard for removal. After the shotcrete has been placed to the depth required, the surface shall be checked with a straightedge or template and any low spots shall be brought up to grade by placing additional shotcrete. The finished surface of the shotcrete shall be left as a natural gun finish unless screeding and or further finishing are specified in Section 19 of this specification.

When specified screeding shall be accomplished as follows: Place shotcrete a fraction beyond the guide strips, ground wires or forms. Allow the surface of the shotcrete to stiffen to the point it will not pull or crack under screeding or troweling. Trim, slice, or scrape excess material to true line and grade and remove the placing guides.

A natural rod finish shall consist of the removal, by floating, of the impressions left after the guide strips or ground wires have been removed.

A natural broom finish shall be that finish resulting from brooming the natural rod finish.

A float finish shall be that finish resulting from floating the natural rod finish with a wood or rubber float.

14. CURING

Shotcrete shall be prevented from drying for a curing period of at least seven (7) days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water, or covering, shall be applied in such a way that the shotcrete surface is not eroded or otherwise damaged.

Water for curing shall be clean and free from any substances that will cause discoloration of the shotcrete where finished surfaces will be exposed to view.

Except as otherwise specified in Section 17 d. of this specification, and except for surfaces to which additional shotcrete is to be applied, shotcrete may be coated with curing compound as an alternative to the continued application of moisture.

The compound shall be sprayed on the moist shotcrete surfaces as soon as rebound has been removed and any required repairs are completed, or as soon as water curing is discontinued.

The curing compound shall be thoroughly mixed immediately before applied and continuously agitated during application. It shall be applied at a uniform rate of not less than one (1) gallon per 100 square feet of surface for natural gun finishes. Curing compound shall be applied in two (2) applications, one (1) in each direction. If a natural rod, broom, or float finish is specified, the curing compound application rate shall be at least one (1) gallon per 150 square feet. Curing compound shall not check, crack or peel, and shall be free from pinholes or other imperfections.

Curing compound shall not be applied to subgrade surfaces or other surfaces requiring bond with subsequently placed shotcrete, such as construction joints, reinforcing steel and other embedded items.

Surfaces subjected to heavy rainfall or running water within three (3) hours after the compound has been applied, or surfaces damaged by subsequent construction operations during the curing period shall be resprayed in the same manner as for the original applications.

Surfaces covered by the membrane shall not be trafficked unless protected from damage and/or wear.

15. REPLACEMENT OR REPAIR

When shotcrete lacks uniformity, exhibits segregation, honeycombing, or laminations, or contains dry patches, slugs, voids or sand pockets the Contractor shall remove and replace the defective shotcrete. The Engineer's concurrence in the extent of removal and replacement is required.

Prior to starting significant removal and replacement work the Contractor shall obtain the Engineer's approval of their plan for making the repair. Such approval shall not be considered a waiver of the Contracting Officer's or owner's right to require complete removal of defective work if the completed repair does not produce shotcrete of the required quality and appearance.

Repair work shall be performed only when the Engineer is present.

Repair shall be made with shotcrete conforming to this specification. When removal of defective shotcrete is required, reinforcement damaged or destroyed shall be replaced prior to replacement of the shotcrete. At the edges of removed sections the sound shotcrete shall be carefully trimmed to the extent required to expose sufficient reinforcement for effecting competent splices. The sound shotcrete at the edges of removed sections shall be trimmed to a slope of approximately 45 degrees with the surface of the work and shall be thoroughly moistened prior to placement of the new shotcrete.

Any portions of the work having thickness less than those specified may be repaired by the placement of additional layers of shotcrete, provided that such repair is expressly approved by the Engineer.

Surfaces of the work to which additional shotcrete is to be applied shall be prepared as required by Section 11 of this specification.

Curing as specified in Section 14 of this specification shall be applied to repaired areas immediately after the repairs are completed.

16. PLACING IN COLD WEATHER

When the atmospheric temperature may be expected to drop below 40° F at the time shotcrete is placed, or at any time during the curing period, the following provisions shall also apply:

- a. Shotcrete placement shall be permitted when the air temperature is at least 40° F and rising. Placement shall be discontinued if the temperature falls to 40° F and is expected to continue to fall.
- b. The temperature of the shotcrete at time of placing shall not be less than 50° F nor more than 90° F. The temperature of neither aggregates nor mixing water shall be more than 100° F just prior to mixing with the cement.
- c. When the daily minimum temperature is less than 40° F, shotcrete shall be insulated or housed and heated after placement. The temperature of the shotcrete and air adjacent to the shotcrete shall be maintained at not less than 50° F nor more than 90° F for the duration of the curing period.
- d. Methods of insulating, housing and heating the structure shall be in accordance with "Standard Specification for Cold Weather Concreting," ACI Standard 306.1.
- e. The use of accelerators or antifreeze compounds will not be allowed unless otherwise specified.
- f. When dry heat is used to protect shotcrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the shotcrete has been coated with curing compound as specified in Section 14 of this specification or is covered tightly with an approved impervious material.

17. PLACING IN HOT WEATHER

When climatic factors such as high air temperature, reduced relative humidity and increased wind velocities are present, or conditions are such that the temperature of placed shotcrete exceeds 90° F at, or during the first 24 hours after placement, the following provisions shall also apply:

- a. The Contractor shall maintain the temperature of the shotcrete below 90° F during mixing, conveying, and placing using the methods given in items b, c, and d below.
- b. Exposed shotcrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying immediately after placement.
- c. Shotcrete surfaces exposed to the air shall be covered as soon as the shotcrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in Subsection d., below.
- d. If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately, following the procedures specified in Section 14 of this specification.

18. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the dimensions of the exposed surface of the shotcrete will be measured to the neat lines shown on the drawings and the surface area will be computed to the nearest square foot. Payment will be made at the contract unit price for shotcrete. Such payment will constitute full compensation for completion of the work, including making and handling test panels but not including reinforcing steel or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

Method 2 For items of work for which specific unit prices are established in the contract, cement and aggregates used in shotcrete and in authorized test panels will be measured by the batch weights of the materials charged into the mixer. No deduction will be made for normal rebound; however, payment will not be made for material wasted because the in-place shotcrete does not conform to the specifications. Payment will be made at the contract unit prices for cement and aggregates for shotcrete. Such payment will constitute full compensation for completion of the work, including making and handling test panels but not including reinforcing steel or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

All Methods The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 19 of this specification.

END OF SECTION

SELECT MASONRY CLEANING

PART 1--GENERAL

1.01 SUMMARY

- A. The procedures prescribed include guidance for select masonry cleaning using a Biocide Agent and a separate Rust Removal Agent.
- B. Rust Removal Procedure is to be priced as Add Alternate #1.
- C. Biocide Treatment shall be included in Base Bid.

1.02 REFERENCES

- A. See Specification Section 010300, Add Alternate #1 – Rust Removal
- B. See Specification Section 042110, Select Removal and Replacement of Deteriorated Brick
- C. See Specification Section 044640, Select Masonry Repointing

1.01 QUALITY ASSURANCE

- A. Certificates: Prior to delivery, submit certificates attesting to compliance with applicable specifications for each product.
- B. Cleaning Mock Up Panel(s): Prepare separate, in-situ mock up panels of rust removal and biocide treatment. Mock ups to be of size and location agreeable to both contractor and architect. Use manufacturers' application instructions. Let test panels dry 4 to 7 days before inspection. Outline with blue tape, and keep test panels available for comparison throughout the cleaning process.

1.02 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: No cleaning shall be performed when the air temperature or brick surface temperature is 40F and falling during and for 48 hours subsequent to cleaning/rinsing procedure.

PART 2---PRODUCTS

2.01 MANUFACTURERS

- A. Rust Remover Manufacturer (Add Alternate #1):
ProSoCo, Inc.
3741 Greenway Circle
Lawrence, KS 66046
1.800.255.4255
CustomerCare@prosoco.com
- B. Biocide Manufacturer (Base Bid):
Cathedral Stone Products, Inc.
7266 Park Circle Drive

Hanover, MD 21076
1.800.684.0901

2.02 MATERIALS

- A. Rust Remover (Add Alternate #1): Sure Klean Ferrous Stain Remover manufactured by PROSOCO, Inc., or Architect approved acidic cleaning product that effectively removes iron, manganese, vanadium, straw stains, acid burns and other metallic discolorations from brick, stone and other masonry surfaces.
- Physical Form: Clear Amber Liquid
 - Specific Gravity: 1.168 g/cc
 - Total Solids: N/A
 - pH: 0.17 (concentrate)
 - Wt./Gal: 9.72 lbs.
 - Flash Point: N/A
 - Freeze Point: 3 degrees F
- B. Biocide (Base Bid): D/2 Biological Solution manufactured by Cathedral Stone Products, Inc., or Architect approved non-mutagenic, non-toxic biocide designed to safely remove a broad spectrum of biological deposits from masonry surfaces.
- Physical Form: Transparent, low viscosity liquid
 - PH: 9.5
 - Specific Gravity: 1.01 g/cc
 - Solubility in Water: Complete
 - Vapor Pressure: 25 mm Hg @ 20 Celcius
 - Coverage: Typical coverage to remove medium deposits varies from 250 to 350 square feet per gallon

PART 3---EXECUTION

3.01 RUST REMOVER APPLICATION (ADD ALTERNATE #1)

- A. Note: Rust Removal work shall be performed prior to masonry restoration work prescribed in other sections of this specification, including masonry resetting and repointing work.
- B. Before applying, read "Preparation" and "Safety Information" sections in Manufacturer's Product Data Sheet for Ferrous Stain Remover. Follow all manufacturer's safety procedures and recommendations. Use Ferrous Stain Remover in concentrate or dilute with up to 3 parts water. Coordinate in-situ mock-up treatment panel(s) as required by Architect to determine required strength for specific application. Test panels need to dry 4 to 7 days before inspection.
- Prior to beginning, always pre-wet the masonry surface with clean, potable water.
 - Apply diluted cleaning solution directly to the masonry surface.
 - Let the cleaner stay on the surface for 3-5 minutes. **Do not let it dry into the masonry between applications or before final rinse.** If treated surfaces are left unattended, keep people away from cleaner.
 - Reapply cleaner and rinse with fresh, potable water. Gently rinse cleaner from surface of masonry using masonry washing equipment generating between 400 and 1000 psi with a flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.

- e. Rinse spray equipment shall be adjustable to reduce water flow rate and rinsing pressure as required for controlled cleaning of sensitive surfaces. See also manufacturer's "Equipment" section of Product Data Sheet.
- f. Thoroughly rinse all residue from the surface of the masonry. Brush the wall in a circular motion with a short fibered, non-metallic scrub brush while rinsing.

3.02 BIOCIDES APPLICATION (BASE BID)

- A. Note: Biocide Application shall be performed prior to masonry restoration work prescribed in other sections of this specification, including masonry resetting and repointing work.
- B. Before applying, read "Preparation" and "Safety Information" sections in Manufacturer's Product Data Sheet for Biological Solution. Use Biological Cleaner either full strength or diluted. Follow all manufacturer's safety procedures and recommendations. Coordinate in-situ mock-up treatment panel(s) as required by Architect to determine required necessary pre-cleaning method, number of biocide applications required for specific application and possible dilution volumes (up to 1 part biocide to 4 parts water).
 - a. First, pre-clean heavy biological growth by using a low-pressure washer (600 to 1000 psi), and using wooden or plastic tools immediately after misting with one (1) part D/2 Solution to two (2) parts water.
 - b. After pre-cleaning, brush, roll, or pump spray biocide onto masonry surface. First test to see if a diluted solution will be effective. If diluted solution is ineffective, proceed to testing using full strength D/2.
 - c. Scrub biocide thoroughly into surface with a non-metallic, short fibered scrub brush.
 - d. Allow the undiluted biocide to remain on the surface for 1 or 2 minutes, then apply additional biocide to maintain wet surface and continue scrubbing.
 - e. Rinse thoroughly with clean, potable water using a hose or a pump sprayer.
 - f. For light deposits, the D/2 biocide can be diluted with water from 1:1 to 1:4 parts water by volume. Perform small tests to determine whether dilutions will provide effective removal of growth. For optimal action, dilutions should remain on the surface for 2 to 10 minutes. Apply the dilution(s) as described above: apply, scrub, wait, reapply, mist, then scrub again and rinse. Prepare fresh dilutions daily.

END OF SECTION

SELECT REMOVAL AND REPLACEMENT OF DETERIORATED BRICK MASONRY

PART 1--GENERAL

1.01 SUMMARY

- A. This section specifies removal and replacement of deteriorated brick masonry.

1.02 REFERENCE

- A. See Specification Section 042030, Select Masonry Cleaning
- B. See Specification Section 044640, Select Masonry Repointing

1.03 QUALITY CONTROL

- A. Perform mock-up examples of typical removal/restoration work for review by Architect. One mock up shall be for multiple brick replacement, one mock-up shall be for single brick replacement. Do not proceed with work until approval has been received by Architect.

1.04 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not proceed with brick replacement under adverse weather conditions, or when temperatures are below or above limitations set forth in Brick Repointing Specification Section; Proceed with the work only when forecasted weather conditions are favorable for proper cure.
2. Wet Weather: Do not apply or mix mortar on outside surfaces with standing water or outside during rain.
3. Cold Weather construction is not allowed. Cold weather is considered to occur when when surface temperature of masonry is below 40 F. or air temperature is predicted to be below 40 F. within 72 hours. See #6 below.
4. Hot Weather: The surface temperature of the work, not the ambient temperature, should not be higher than 90 F.; Mortar mixing should be done only in the shade; Cover mortar with water-misted burlap in hot weather to reduce evaporation; Pointing work should be done in the shade. Work around the building during the day so that the fresh work will be shielded from direct sunlight to reduce evaporation rate. High temperatures can cause flash setting of cement mortars and rapid evaporation of water in the mix, leading to lack of development of final strength by the cement.
5. All materials, including replacement brick must be kept above 40 F.
6. Special Precautions and Notes: Do not allow masonry to freeze until mortar is thoroughly dry and hardening almost complete (approx. three days time); The setting of cement/lime mortar is much slower than that of cement mortar because the curing requires the absorption

of carbon dioxide to form hard lime carbonates; It is a lengthy process, so do not expect it to become hard immediately, especially at the core of large masses of masonry.

PART 2---PRODUCTS

2.01 MATERIALS

- A. Replacement Brick: Waterstruck, (2-1/8" x 3-5/8" x 7-5/8"). Note that this is a special, restoration size brick, and not a modern, standard module. Color range to match existing as manufactured by Morin Brick or Architect approved equal. Brick shall comply with ASTM C-216, Grade SW, Type FBA specifications.
- B. Salvaged Brick: Approved by Architect, sound, crack free, mortar free, clean brick without face chips larger than 3/8 inch, salvaged from removal of identical face brick work of same type, or salvage yard with precise match. Note that salvage brick must be virtually mortar free from bedding surfaces. Bedding surfaces shall not be damaged and shall not contain over 15%, evenly disbursed coverage of old mortar. Do not use power tools to clean mortar from salvage brick. Only use hand tools in the gentlest means possible to assure no damage to brick surfaces.
- C. Nylon dowels: Threaded rods, 1/2 inch diameter, 13 threads per inch.
- D. Epoxy: PolyPlus SF by Helifix, or Engineer-Approved Equivalent.

2.02 EQUIPMENT

- A. Trowel
- B. Joint tools
- C. Chisel
- D. Hawk
- E. Hammer
- F. Stiff bristle brushes
- G. **Use of Electric Grinders and other power tools is strictly prohibited on this project, with the exception of the Trow & Holden pneumatic tool system or Architect-Approved equivalent. Contractors must demonstrate skill and handling of pneumatic tool system on a demonstration area for the Architect. Tools must be used on a limited basis, with frequent breaks, to eliminate worker fatigue and decrease opportunity for damaging adjacent brick scheduled to remain.**

PART 3---EXECUTION

3.01 EXAMINATION

- A. Visually inspect surface areas prior to performing work prescribed in drawings. Notify Architect immediately if conditions vary from conditions shown in drawings and from prescribed treatments.

3.02 PREPARATION

A. Surface Preparation:

1. Wet brick having absorption rates greater than 0.025 oz. per sq. inch per minute.
 - a. On the flat side of a brick, deposit water on an area approximately the size of a 25 cent coin.
 - b. If the water disappears in less than 30 seconds, wet the bricks.
2. Absorptive brick should be thoroughly soaked in the pile each afternoon prior to the day they are to be used.
3. Cover stockpile bricks with tarps or heavy paper to prevent evaporation.
4. Wet brick as necessary during the day; Sprinkle the brick pile with a hose for a period long enough for water to run down the side of the pile; Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid; (DO NOT wet stone masonry units).
5. Brick shall be stored well within specified temperature range for pointing work. Do not store stockpile brick at temperatures above 80F or below 55F degrees.
6. Repair flashing as prescribed on drawings.
7. Where fresh masonry joins existing work, clean the exposed surface of the set masonry by removing loose brick and mortar and wet lightly to obtain the best possible bond with the new work.

3.03 ERECTION, INSTALLATION, APPLICATION

A. Replacing Deteriorated Units with Full-Size Bricks:

1. Install temporary shoring as necessary to prevent settling of adjacent masonry scheduled to remain in place. Protect all surrounding surfaces from potential damage caused by selective removal and replacement work.
2. Carefully remove deteriorated brick units by hand using a hammer and chisel.
3. Rebuild back-up and substrate as required to replace any unsound material that was removed.

4. Clean the cavity of loose mortar and other debris by hand using a chisel and stiff bristle brushes.
5. Lightly wet the exposed brick surfaces.
6. Follow procedures prescribed in Specification Section 044640, Masonry Repointing.
7. Lay brick units with completely filled bed and head joints; Butter ends with sufficient mortar to fill head joints and shove into place.

NOTE: Lay masonry plumb and true following the coursing and patterns of the adjacent existing sound construction; Level off work at required heights and form beds to build-in salvaged or moved materials.

8. If adjustments are required, remove units, completely clean off mortar and reset in fresh mortar.
9. Blend new work into existing work smoothly with no lines of demarcation and no change of pattern or coursing. All work shall be toothed into existing bonding courses. No patches will be accepted that do not replicate original, continuous bonding pattern.
10. Brush all excess mortar from the wall surface frequently during the work; Protect all existing surfaces from mortar dripping and splashing.

3.04 ADJUSTING/CLEANING

- A. Clean adjacent surfaces which have been spattered during the course of the work. Rinse immediately with clean, potable water.
- B. Wipe all excess mortar as the work progresses. Dry brush at the end of each day's work.
- C. After mortar is thoroughly set and cured, remove loose mortar and dirt from new masonry surfaces.
- D. Wash down the masonry surface with clean, potable water.

END OF SECTION

SELECT MASONRY REPOINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. This procedure includes guidance on removal of select areas of existing mortar and re-pointing of specified joints within brick surfaces. Mortar mix shall also be used as bedding material for reset brick.

1.02 REFERENCES

- A. See Specification Section 010300, Add Alternate #1 – Rust Removal
- B. See Specification Section 042030, Select Masonry Cleaning
- C. See Specification Section 042110, Select Removal and Replacement of Deteriorated Brick
- D. American Society for Testing and Materials (ASTM), 100 Barr Drive, West Conshohocken, PA 19428, (610) 832-9585 or FAX (610) 832-9555.

1.03 QUALITY ASSURANCE

- A. Certificates: Prior to delivery, submit certificates attesting to compliance with applicable specifications for grades, types and classes.
- B. Joint Raking: Prior to raking out all areas, cut back joints at location(s) prescribed by Architect using the methods specified. Raking will continue at no additional cost to the Owner, until an acceptable sample is achieved. This area will serve as the standard for joint raking for the entire job. It will be marked with masking tape and left unpointed until all other pointing is complete. Point sample area at completion of pointing work.
- C. Sample Brick Pointing: Repoint joints, using materials and methods specified at a location selected by the Architect. The sample accepted by the Architect for color and tooling match will serve as a standard for the entire job. It will be marked with tape and left undisturbed. Pointing mortar shall match historic mortar in appearance, strength and composition.

1.04 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: No brick pointing or repair shall be performed when the air temperature or brick surface temperature is 40 F, and falling during and for 72 hours subsequent to laying.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Mortar For Brick Pointing: Follow manufacturer's printed recommendations for product use and installation.

1. Portland Cement: ASTM C150, Type I White Portland Cement.
2. Hydrated Lime: ASTM C207, Type N.
3. Aggregate: ASTM C144; clean, sharp sand free of loam, silt soluble salts and organic matter. Owner has performed lab tests on the existing mortar to determine aggregate composition for use in repointing mortar (see mortar analysis test results, attached):

Sieve Size	Percent Retained
No. 4	0
No. 8	0
No. 16	5%
No. 30	25%
No. 60	45%
No. 100	20%

4. Water: Clean, potable and free of any oil, acid, alkalis or organic matter.

2.02 MIXES

- A. Proportions for Brick Pointing (1:1:6, Cement, Lime, Aggregate):
 Mix/proportions for aggregate color and texture shall closely match historic and shall be approved in mock-up by Architect.
 1. White Portland Cement: 1 part by volume
 2. Hydrated Lime: 1 part by volume.
 3. Aggregate: 6 parts by volume.
 4. Water: to form a workable consistency.
- B. Mixing Procedures:
 1. Measure materials by volume or equivalent weight.
 2. Do not measure by shovel. Use known measure.
 3. Mix ingredients in clean mechanical batcher for 3-5 minutes.
 4. Let mortar sit for 20 minutes prior to use to allow for initial shrinkage. Use mortar within 1 hour of initial mixing.

PART 3 - EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION

- A. **Power Tools shall not be permitted on this project. One exception is the Trow & Holden Pneumatic Tool System. Rotary Saws and Grinders are Prohibited.**
- B. Rake out all joints in designated areas by hand using a chisel narrower than existing joint.
- C. Clean all mortar from surfaces within the joint or crack so that the new pointing mortar bonds to the masonry, not old mortar. Up to 15% of masonry surface may remain covered in mortar, if the mortar proves overly difficult to remove by hand and and if

evenly distributed over the bedding surface. Do not chip or spall edges of the brick. More than one 1/4" chip per square yard shall be unacceptable. If work is found unacceptable, all raking will cease without additional cost to the Owner until deficiencies in tools, workers or methodologies have been corrected to the Architect's satisfaction.

- D. Joint depth to be at least two times the width of the joint, but in all cases rake back to expose sound mortar. See drawings for prescribed mortar repointing depth.
- E. Brush, vacuum and/or flush joints with clean, potable water to remove all dirt and loose debris.
- F. Reduce initial absorption of the brick by thoroughly wetting brick surface with clean, potable water just prior to repointing. Do not allow water to pool on surface of the brick.
- G. Pack joints with mortar leaving no voids. Place mortar in layers (lifts) not exceeding 1/4" deep until joint is filled. Apply succeeding lifts only after preceding layer has taken initial set.
- H. Use clean tools and equipment free from hardened or partially set mortar.
- I. Clean excess mortar from brick and joints, removing splashed mortar and droppings immediately.
- J. Do not retemper or use mortar which has partially set, is caked, or is lumpy.
- K. Pointing Joints 1" deep: Using a long, thin pointing trowel, tightly pack mortar into joints in layers not exceeding 1/4" thick to fill joint to match original sound joints.
- L. Pointing Joints Deeper than 1": Begin by filling areas from which mortar is missing to a depth greater than 1" in 1" thick layers to within 1" of wall surface. This shall provide a uniform substrate for final pointing. Fill final 1" deep continuously and uniformly in 1/4" thick layers (lifts).
- M. General Pointing: Firmly iron each layer to compact mortar to ensure a full bond between mortar and masonry and a firm, solid joint. Allow each layer to reach "thumbprint" hardness before applying succeeding layer. Do not let previous layer dry out before applying succeeding layer. Construct uniform joints. Do not spread mortar over edges onto exposed surfaces of masonry. Never featheredge mortar.
- N. Surface Tooling: After final layer of mortar is "leather hard", tool joints with a flat rule jointer, or as directed by Architect. Tool joints to profile accepted by Architect in mock-up. Solidly compress mortar so that it adheres well to masonry on both sides and forms a dense surface. Premature or late tooling will result in unacceptable finishes that are not acceptable. Duplicate the finish of a slightly weathered joint by brushing newly pointed joints with a non-metallic fiber bristle brush to produce a slight "breathable" texture.
- O. Curing: Keep newly pointed joints damp for at least 48 hours after mortar has been placed. Do not apply a direct stream of water to joints for at least 24 hours after mortar has been placed. Maintain joints at 90% relative humidity for at least 72 hours or until surface is cured. Protect joints from rapid drying due to wind and or sun. Ensure

masonry temperature remains as required by specifications until mortar is thoroughly cured.

- P. When stopping work at end of day or for more than one hour, stagger layers of mortar a minimum of 3" so that there are no through joints in the pointing mortar.

3.02 ADJUSTING/CLEANING

- A. At the time of pointing of the brick, immediately remove mortar, grout and sealant from the face of the masonry.
- B. Use only tools and equipment which are clean and free of hardened or partially hardened material.
- C. Clean brick only with fiber bristle brushes and clean, potable water. Use no acids, detergents, or other cleaning agents unless specified in other sections. If cleaning treatments are specified in other sections, these treatments must be performed before the old mortar is removed and new mortar is installed. No aggressive cleaning shall be allowed after the repointing begins.
- D. Defective Work: Any masonry pointing that does not match job sample panel and/or result in a consistent appearance with adjacent joint surfaces and accepted mock-up panel shall be considered defective. The Contractor shall correct all defective areas to the satisfaction of the Architect at no additional cost to the Owner.

3.03 PROTECTION

- A. Fine mesh debris netting is to be secured to the outside of scaffolding or work area to protect the work area from strong winds and sunlight. Securely fixed polythene shall be placed over plywood sheeting on the top of the protected area to ensure that rain does not wash down the face of masonry. Polythene shall never come in contact with the work. Accurate records of the minimum and maximum temperatures below the covers should be taken daily, with provision to record these over weekends and holiday breaks. To avoid rapid drying and consequent high shrinkage, especially in hot or windy weather conditions keep all work damp by repeatedly applying a fine mist of clean potable water, if necessary several times a day, until the mortar has hardened.

END OF SECTION

SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of 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 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 DESCRIPTION OF WORK:

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in AISC “Code of Standard Practice” and as otherwise shown on drawings.

1.03 RELATED WORK

- 1. Section 05 30 00 – Metal Deck
- 2. Section 05 50 00 - Metal Fabrications

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with latest provisions of the following, except as otherwise indicated:
 - 1. AISC “Code of Standard Practice for Steel Buildings and Bridges”, Latest Edition.
 - a. Exclude the word “structural” in reference to the “Design Drawings” in section 3.1 of the Code.
 - 2. AISC “Specification for Structural Steel Buildings”, including “Commentary” and Supplements issued thereto.
 - 3. AISC “*Specifications for Structural Joints using ASTM A 325 or A 490 Bolts*” approved by the Research Council on Structural Connections of the Engineering Foundation.
 - 4. AISC 341, “Seismic Provisions for Steel Buildings”.
 - 5. AWS D1.1 - “Structural Welding Code” - Steel.
 - 6. AWS D1.3 - “Structural Welding Code” - Sheet Steel.

7. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
 8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."
1. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.
 2. If re-certification of welders is required, retesting will be the Contractor's responsibility.
- C. Fabricator Qualifications: Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for SBD – Conventional Steel Building Structures, STD – Standard for Steel Building Structures. Fabricator shall be certified at time of bidding and for duration of project.
1. Alternate: A non-AISC certified fabricator will be accepted if subjected to third party inspections per chapter 17 of the International Building Code, including: inspections of quality control procedures, fabrication procedures, review of welder certifications, and inspection of shop welds. Costs of these third party inspections are to be born by the fabricator.

1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. INCOMPLETE SUBMITTALS WILL NOT BE REVIEWED.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.
 2. High-strength bolts (each type), including nuts and washers.
 3. Structural steel primer paint (where applicable).
 4. Structural steel top coat paint (where applicable). (Refer to Section 09900.)
 5. AWS D1.1 Welder certifications.

6. Expansion/Adhesive Anchors (coordinate with section 03300).
- J. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.
- K. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.
- L. Shop Drawings:
 1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
 - a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
 - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.
 2. Alternate Connection Design: Connections for all beam, column, braced frame, and moment connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD) have been designed and detailed in the drawings. Alternate connection design shall be allowed only with prior approval of the Structural Engineer. If such approval is granted, all redesigned connections shall be designed by the fabricator's engineer, registered in the State of Maine. Calculations for redesigned connections shall be signed and sealed.
 3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.
 4. LEED Documentation: Refer to paragraph 1.07 of this section and Division 1.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

1.07 LEED Requirements:

- A. Material Recycled Content: Structural Steel shall be meet the following minimum recycled content:
 - 1. The sum of the post consumer recycled content + $\frac{1}{2}$ the sum of pre-consumer recycled content: 80% Minimum
 - 2. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.
- B. Local/Regional Materials: Structural steel source (mill) and fabricator shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the project site.
- C. Waste Management: Collect offcuts and scrap and place in designated areas for recycling.

PART 2 PRODUCTS

2.01 MATERIALS:

- A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.
- B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)
- C. Steel Tube: ASTM A 500, Grade B, $F_y = 46$ ksi.
- D. Steel Pipe: ASTM A 53, Grade B.
- E. Anchor Bolts: ASTM F1554, Grade 36 weldable steel, unless noted otherwise on drawings. Anchor rods that are to be exposed to weather, located in unheated enclosures, or in contact with pressure treated lumber shall be hot dipped galvanized. All anchor bolts shall be headed or double nutted. "J" or "L" type anchor bolts are not permitted. Unless otherwise noted, specified embedment it to top face of head or nut.
- F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

- G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.
 - 2. Direct tension indicator washers or bolts may be used at Contractor's option.
- H. Steel Shear Studs: Headed type manufactured from steel conforming to ASTM A108 Grade C1015 by KSM or Nelson. Refer to Drawings for diameter and length.
- I. Electrodes for Welding:
 - 1. Minimum 70 ksi electrodes. Filler material shall meet the grouping requirements per AWS D1.1 Table 3.1 for matching strength of connected materials.
 - 2. All filler metal used welding shall meet the following Charpy V-Notch (CVN) requirements.
 - a. 20 ft-lb at 0 degrees Fahrenheit unless noted otherwise.
 - b. 20 ft-lb at -20 degrees Fahrenheit and 40 ft-lb at 70 degrees Fahrenheit at all complete joint penetration (CJP) groove welds.
- J. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.
- K. Non Shrink Cement-Based Grout: See Section 03300
- L. Drilled Anchors: Expansion and adhesive by HILTI, SIMPSON or POWERS/RAWL as indicated on the drawings.

2.02 FABRICATION:

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
 - 1. Provide field bolted connections, except where welded connections or other connections are indicated.
 - 2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

- C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts". Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.
- D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
- F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- G. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all necessary pieces and fabrications as required to safely erect and access the structure for the duration of project construction.
- H. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

2.03 STRUCTURAL STEEL COATINGS

- A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.
- B. To the greatest extent possible, structural steel coatings shall be shop applied.
- C. Galvanizing, priming and painting for structural steel permanently exposed to view shall meet the requirements of Section 10 of the Code of Standard Practice, "Architecturally Exposed Structural Steel".
- D. Provide venting/drainage holes in closed tubular members to be hot-dipped galvanized. Holes shall be provided in a location hidden from view in the final condition and in a manner that will not reduce the strength of the member. Hole locations shall be clearly indicated on the Shop Drawings and are subject to review by the Architect.
- E. Follow manufacturer's installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.
- F. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.
- G. Steel which is to receive spray-on fireproofing shall not to be primed or painted, unless specified by the Architect.
- H. Coatings: All exterior steel and/or steel permanently exposed to view shall receive a coating. Unless noted otherwise, refer to Division 9 specifications for products and surface preparation requirements.

- I. Brick masonry loose lintels and relieving angle assemblies, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings
- J. Unheated structural steel to be enclosed with architectural finishes, including but not by limitation, canopy members and/or roof pop-up members shall be primed with rust inhibitive alkyd primer, Tnemec Series 349 unless noted otherwise. Follow manufacturer's instructions for surface preparation and application. Substitution shall be equal to the above specified products, and shall be submitted for review.
- K. Steel Embedded in Concrete/Below Grade: Steel which is embedded in concrete, below grade/slab level, or as otherwise indicated on the drawings, shall be field painted with cold-applied asphalt emulsion complying with ASTM D 1187. Paint embedded areas only. Do not paint surfaces which are to be welded until welding is complete.
- L. Field Touch-up: Touch-up all paint and galvanizing damage, including but not by limitation, damage caused during shipping, erection, construction damage, and field welded steel. See Division 9 specifications for additional requirements.

PART 3 EXECUTION

3.01 ERECTION:

- A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- C. Surveys: Employ a Registered Land Surveyor to verify elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.
- D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
 - 1. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

2. Welding to anchor bolts for corrective measures is strictly prohibited without prior written approval from the Engineer.

F. Setting Plates and Base Plates:

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to division 3 of the project Specifications for anchor bolt installation requirements in concrete.
2. Clean concrete bearing surfaces of bond-reducing materials. Clean bottom surface of setting and bearing plates.
3. Set loose and attached base plates for structural members on wedges or other adjusting devices.
4. Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Concrete slabs that are part of elevated floors framing systems shall achieve 28-day design strength prior to the application of any superimposed loads such as curtain walls, masonry veneer, mechanical equipment and stairs. Additional testing beyond that specified in division 3 required to verify the concrete strength prior to application of superimposed loads shall be done at the Contractor's expense.

H. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

I. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.
2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.
3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
5. Splice members only where indicated and accepted on shop drawings.
6. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
7. Composite shear studs shall be installed using stud welding process with an appropriately sized insulating ferrule. Fillet welding of shear studs is not permitted.

Ferrules shall be broken free from the shear studs and removed from the deck surface along with all other debris.

- J. Coat columns, base plates, and brace elements encased in concrete and/or below grade with cold-applied asphalt emulsion. Coordinate coating with concrete work.
- K. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.
- L. Coating Damage: Touch up shop applied paint or galvanizing whenever damaged or bare. See "Coatings" sections for additional requirements.
- M. Field Cut Beam Web Penetrations:
 - 1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.
 - 2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.
 - 3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.
 - 4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.
 - 5. The cost of executing field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.
 - 6. Field cut beam web penetrations may not be permitted in certain locations, subject to the evaluation by the Structural Engineer.
- N. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.
- O. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.
- P. Field Welded Moment Connections:

1. Welding of Moment Connections shall meet the requirements of FEMA 353.
2. Backing materials for top and bottom flanges for field welded moment connections shall be removed, backgouge the weld root, and apply a reinforcing fillet weld.
3. Where top flange steel backing materials are utilized, the backing may be left in place. In this case, the backing material shall be welded with a reinforcing fillet weld.

3.02 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
 1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
 1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.
 2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.
- C. Inspection Requirements (to be performed by the Independent Testing Agency):
 1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.
 2. Snug Tight Bolted Connections:
 - a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
 - b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested

bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.

3. Slip Critical Bolted Connections:

- a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
- b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.

4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.

- a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.
- b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:
 1. Radiographic Inspection (RT): ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
 2. Ultrasonic Inspection (UT): ASTM E 164.
 3. Magnetic Particle (MT) inspection procedures may be utilized at the inspectors discretion in addition to RT or UT inspection. MT procedures shall not replace RT or UT procedures without permission from the Structural Engineer.
- c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.

D. Composite Shear Studs/Deformed Bar Anchors:

1. Verify shear stud quantity and arrangement.
2. Visually inspect stud weld. A weld less than 360 degrees is cause for further testing by bending to 15 degrees per item 2 below. Strike all studs with a 3 pound sledge hammer with moderates force. Studs shall make a ringing sound when struck with the hammer. If a stud or studs breaks free, or fails to make a ringing sound, further testing shall be performed per item 4.

3. One stud in 100 shall be tested by bending to 15 degrees from vertical, and one stud in 200 shall be tested by bending to 30 degrees from vertical. Single bent studs may be left bent. Failure of stud weld during bend testing is cause for further testing per item 4.
 4. When failure occurs during bend testing, additional bend testing shall be performed on 10 studs to either side of failed stud. Bend studs to 30 degrees from vertical. If failure occurs during additional testing, continue testing in series of 10 studs beyond failed stud until no failure occurs.
 5. Straighten all studs that were bent in multiple stud testing. Replace all studs that fail.
- E. Inspector shall verify that all ferrules are removed when applicable and that metal deck is free of debris prior to concrete placement.
- F. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.
- G. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

END OF SECTION

SECTION 05 30 00 – METAL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of 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 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 DESCRIPTION OF WORK

- A. Extent of metal floor and roof deck is shown on the drawings and includes type VL composite floor deck, cell closures, end plates, pour stops with vertical leg return lip, metal lath column closures, composite finish strips, and welding washers

1.03 RELATED WORK

- 1. Section 05 12 00 - Structural Steel
- 2. Section 05 50 00 - Metal Fabrications

1.04 QUALITY STANDARDS

- A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:
 - 1. AISI "Specification for the Design of Cold Formed Steel Structural Members".
 - 2. AWS D1.1 "Structural Welding Code" - Steel
 - 3. AWS D1.3 "Structural Welding Code" - Sheet Steel
 - 4. Steel Deck Institute (SDI) " Design Manual for Floor Decks and Roof Decks".
 - 5. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
 - 1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
 - 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
 - 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.

4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
- J. LEED Documentation: Refer to paragraph 1.06 of this section and Division 1
- K. Shop Drawings:
1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings.
 - a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
 - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

1.06 LEED Requirements:

- A. Material Recycled Content: Metal decking shall be meet the following minimum recycled content:
1. The sum of the post consumer recycled content + $\frac{1}{2}$ the sum of pre-consumer recycled content: 80% Minimum
 2. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

- B. Local/Regional Materials: Metal Decking steel source (mill) and fabricator shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the project site.
- C. Waste Management: Collect offcuts and scrap and place in designated areas for recycling.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep deck sheets off ground, using pallets, platforms, or other supports. Protect deck sheets and packaged materials from corrosion and deterioration.
- C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.01 GENERAL:

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. United Steel Deck
 - 2. Wheeling Corrugating Co.
 - 3. Epic Metals Corporation
 - 4. Vulcraft
- B. Materials:
 - 1. Steel for Metal Deck Units:
 - a. Floor Deck Units: ASTM A611, Grade C, D or ASTM 653-94, Structural Quality, grade 40 or higher
 - 2. Miscellaneous Steel Shapes: ASTM A36 minimum.
 - 3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.
- C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.

- D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphoric acid treated.
- E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

2.02 FABRICATION:

- A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.
- B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.
- C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.
- D. Pour Stops: Minimum material thickness shall be 18 gage or as indicate on drawings.. Fabricate vertical leg to accommodate specified slab thickness. Fabricate horizontal leg to minimize field cuts. Provide welded attachment sufficient to resist forces during concrete placement.
- E. Provide all pour stops and accessories necessary to contain concrete for poured concrete surfaces.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.
- B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.
- C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
- D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

- E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.
- F. Do not use decking units for storage or working platforms until permanently installed.

3.02 FASTENING:

- A. Floor Deck: Fasten metal deck to supporting steel members as indicated on the Design Drawings: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced not more than 12" o.c. with a minimum of 2 welds per unit at each support. Secure deck units at 6" oc along brace lines, edge of building or at the edge of openings or deck discontinuity. Secure deck to each supporting member in ribs where sidelaps occur. Use welding washers where recommended by the deck manufacturer. Deck units shall bear over the ends of supports by a minimum of 1.5. Sidelaps: #10 Tek screws, 5/8" arc puddle welds or 1" long fillet welds, intervals not exceeding 36 inches. Crimped or button punched sidelaps are not permitted.
- B. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- D. Reinforcement at openings: Provide additional metal reinforcement and closures pieces as required for strength, continuity of decking and support of other work shown.
 - 1. Deck penetrations affecting no more than (1) deck rib need not be reinforced.
 - 2. For deck penetration affecting more than (1) deck rib, but less than 10", reinforce the opening with a 0.057" thick plate spanning between unaffected ribs, unless otherwise shown on the Design Drawings or supporting a piece of mechanical equipment (see item 3).
 - 3. Reinforce deck penetrations larger than 10" with the structural frame described in the Design Drawings.
- E. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.
- F. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.
- G. Touch-Up Painting:
 - 1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

- a. Touch up painted surfaces with same type paint used on adjacent surfaces.
- b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.03 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
- B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
- D. Deck Testing Requirements (to be performed by the Independent Testing Agency):
 1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.
 2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

END OF SECTION

SECTION 055000 - 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. This Section includes the following:

1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Elevator machine beams, hoist beams.
5. Support angles for elevator door sills.
6. Loose bearing and leveling plates.
7. Metal ladders.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

- C. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Stairs."
5. Division 05 Section "Pipe and Tube Railings."
6. Division 06 Section "Rough Carpentry" for metal framing anchors.
7. Division 14 Section "Hydraulic Elevators" for elevator pit ladders and support angles for elevator door sills.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

- B. Thermal Movements: Provide exterior metal fabrications 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 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Prefabricated building columns.
 - 3. Metal nosings and treads.
 - 4. Paint products.
 - 5. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- 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.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 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, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).
- D. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

- K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; 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, hot-dip galvanized per ASTM A 153/A 153M.
- L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.6 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 Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devco Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, 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.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.8 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Provide bearing plates welded to beams where indicated.
 - 2. Drill girders and plates for field-bolted connections where indicated.
 - 3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.
- E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.
 - 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 - 2. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.
- F. Galvanize miscellaneous framing and supports where indicated.
- G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 PREFABRICATED BUILDING COLUMNS

2.10 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. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.11 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 after fabrication.
- C. Prime plates with zinc-rich primer.

2.12 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 not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 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 and interior miscellaneous steel trim at damp locations, where indicated.

2.14 METAL LADDERS

- A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails 16 inches (406 mm) apart, unless otherwise indicated.
4. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
2. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. 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.
5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
6. Available Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.
7. Galvanize and interior ladders, where indicated, including brackets and fasteners.
8. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

2.15 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.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry,

unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.17 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Dull Satin Finish: No. 6.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.18 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

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 bolts, 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 will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

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 operable partitions 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 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.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

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 the following:
 - 1. Preassembled steel stairs with concrete-filled treads.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
 - 2. Division 05 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
 - 3. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings.
 - 4. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
 - 5. Division 09 Section "Gypsum Board" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Prefilled metal-pan stair treads.
 - 2. Paint products.
 - 3. Grout.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed).
- C. 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.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.
- F. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- G. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 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 Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Available Products:
 - a. ICI Devco Coatings; Catha-Coat 313.
 - b. Moore, Benjamin, & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - c. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, [**railings**,] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

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

2.7 STEEL-FRAMED STAIRS

- A. Available Manufacturers:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
- B. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld or bolt stringers to headers; weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch (1.7 mm).
1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
 2. Steel Sheet: Galvanized steel sheet, in damp areas.
 3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 5. Shape metal pans to include nosing integral with riser.
 6. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
 7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with smooth soffits.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- E. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with 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.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, 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 nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

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 the following:
 - 1. Steel pipe railings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Stairs" for steel tube railings associated with metal stairs.
 - 2. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
 - 3. Division 09 Section "Gypsum Board" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 2. Stainless Steel: 60 percent of minimum yield strength.
 - 3. Steel: 72 percent of minimum yield strength.
- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Infill of Guards:

- a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings 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 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of finishing and connecting members at intersections.
- E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For testing agency.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Pipe and Tube Railings:
 - a. Pisor Industries, Inc.
 - b. Sharpe Products.
 - c. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

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

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. At interior locations cover anchorage joint with flange of same metal as post, attached to post with set screws.
- C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.
- D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.7 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOUCMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Framing with dimension lumber.
 - 2. Wood blocking and nailers.
 - 3. Sheathing applied.
 - 4. Z-furring supporting plywood wall sheathing.
 - 5. Plywood backing panels.
 - 6. Cedar ceiling.
 - 7. Building paper.
 - 8. Blocking for construction, accessories and Owner furnished items.
- B. Related Sections include the following:
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Division 7 Section "Thermal Insulation" for rigid insulation installed with z-furring and exterior plywood sheathing.

1.03 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. 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. WCLIB - West Coast Lumber Inspection Bureau.
 - 4. WWPA - Western Wood Products Association.
 - 5. FSC - Forest Stewardship Council

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. 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, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood and plywood.
 2. Fire-retardant-treated plywood.
 3. Engineered wood products.
 4. Power-driven fasteners.
 5. Powder-actuated fasteners.
 6. Expansion anchors.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- B. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer for both treatment and fire-retardant formulation.
- C. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood and other panels flat. Place spacers between each bundle of lumber, plywood, and panel products to provide air circulation. Provide for air circulation around stacks and under coverings.
1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 WOOD AND PANEL PRODUCTS, GENERAL

- A. 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Wood Structural Panels:
1. Plywood: DOC PS 1.
 2. Oriented Strand Board: DOC PS 2.
 3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
 4. Factory mark panels according to indicated standard.
- D. All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
1. Preservative Chemicals: Copper Azole, CBA-A or CA-B, Wolmanized Natural Select.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood sills, blocking, furring, and similar concealed members in contact with masonry or concrete.
 - 2. Wood framing members less than 18 inches above grade.
 - 3. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.

2.04 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWWA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5516, for plywood.
 - 2. Use treatment that does not promote corrosion of metal fasteners.
 - 3. Use Interior Type A High Temperature (HT), unless otherwise indicated.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Application: Treat items indicated on Drawings, and plywood backing panels.

2.05 DIMENSION LUMBER FRAMING

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. Maximum Moisture Content: 19 percent .
- C. Joists, Rafters, and Other Framing: No. 2 or better grade and the following species:
 - 1. Spruce-pine-fir; NLGA.

2.06 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Strapping.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2grade lumber with 19 percent maximum moisture content and any of the following species:
 - 1. Spruce-pine-fir; NLGA.
 - 2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWP.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Spruce-pine-fir (south) or Spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

- D. 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.

2.07 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural Isheathing, fir species.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch, except as otherwise noted.

- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.
3. Product: Allowed instead of plywood sheathing; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel; no substitution.

2.09 CEDAR CEILING

- A. Dimension: 1 inch x 4 inch, nominal.
- B. Tongue and groove.
- C. Blind nailing.

2.08 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing, fir species.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch, unless noted otherwise.

- B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 7/16 inch unless noted otherwise .
3. Product: Allowed instead of plywood sheathing; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel only; no substitution.

2.09 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch nominal thickness.

2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, in roof area, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
3. Where pressure-preservative treated lumber is being fastened or fastened into, provide Type 304 stainless steel fasteners.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Plywood Sheathing to Cold-Formed Metal Framing: Hilti Kwik-Flex or Elco Dril-Flex; no substitution, 10-24 x 1-1/4" wafer head #3.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.11 METAL FRAMING ANCHORS

- A. Manufacturer: Simpson Strong-Tie Co., Inc.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
 - 1. Use for interior locations where stainless steel is not indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior locations, locations in contact with pressure-preservative treated lumber, and where indicated.
- E. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.050 inch.
- F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: As needed for condition.
 - 2. Thickness: 0.050 inch.
- G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

2.12 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install framing members of size and spacing indicated.
- E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- F. Do not splice structural members between supports, unless otherwise indicated.
- G. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- 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. Do not use panel 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.
- J. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- K. Securely attach rough carpentry and panel work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 - 3. Published requirements of metal framing anchor manufacturer.
 - 4. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
- L. 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 between members. Install fasteners without splitting wood; predrill as required.

1. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
 2. Use stainless steel nails where fastening or fastening into preservative-treated framing members.
- M. 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.
- N. Sheathing shall not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- O. 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.

3.02 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support construction and fixtures, including, but not limited to, equipment services, heavy trim, grab bars, toilet accessories, casework, furnishings, window treatment, handrail brackets, shelving, residential casework, building specialties, clothes rods, shower curtain rods, window sills, drywall window return shims, countertop supports, wall panels and standoff supports, postal specialties, panel board supports, tack boards and marker boards, Owner furnished items, metal flashing, siding and trim support, roof blocking, base flashing backer, and equipment supports, and miscellaneous items and construction. Provide 3/4-inch thick plywood covering a minimum of 32 inches square for toilet accessories. Provide 1-1/2 inch thick blocking minimum, for grab bars, door stops and handrail supports. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
1. Provide concealed wood blocking behind gypsum wallboard where door stops are to be installed.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- C. Roofing Nailers: Install wood nailers of same total thickness as insulation. Anchor perimeter nailers to substrate in a manner to resist a force of 100 pounds per linear foot in any direction. Top nailer shall be fastened through the lower layers and into metal deck or concrete plank.

3.03 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
1. Where supported on wood members, by using metal framing anchors.
 2. Where framed into wood supporting members, by using metal joist hangers.
- B. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

- C. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- D. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to 3 joists.
- E. Anchor engineered framing with metal framing anchors, of size and type indicated.
- F. Provide bridging of size and type indicated on Structural Drawings.

3.04 RAFTER FRAMING INSTALLATION

- A. Rafters: Notch to fit exterior wall plates and use metal framing anchors.

3.05 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing and trusses.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 2. Plywood Backing Panels: Screw to supports.

3.06 Z-FURRING, RIGID INSULATION, AND SHEATHING INSTALLATION

- A. Install rigid insulation furnished under Division 7 "Building Insulation" horizontally and hold in place with Z-furring members spaced 24 inches o.c., unless indicated otherwise.
- B. Fasten Z-furring members securely through gypsum sheathing into cold-formed steel framing. Screw fasteners spaced no greater than 12 inches on center.
- C. Except at exterior corners, securely attach narrow flanges of furring members to wall with fasteners spaced not more than 12 inches o.c.
- D. 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.
- E. Protect rigid insulation from exposure to sunlight by installing wall sheathing to z-furring immediately. Fasten in accordance with requirements "Wood Structural Panel Installation" article above.

3.07 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover wall sheathing with weather-resistant sheathing paper as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.

2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.
- B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.

END OF SECTION 06100

SECTION 064013 - EXTERIOR 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. This Section includes the following:
 - 1. Exterior standing and running trim.
 - 2. Exterior frames and jambs.
 - 3. Shop priming exterior woodwork.
 - 4. Shop finishing exterior woodwork.
 - 5. PVC foamboard.

1.3 SUBMITTALS

- A. Product Data: For each type of product and process indicated and incorporated into items of exterior architectural woodwork during fabrication, finishing, and installation.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of blocking and nailers, including concealed blocking and reinforcement specified in other Sections.
 - 3. Apply WI-certified compliance label to first page of Shop Drawings.
- C. Samples for Verification:
 - 1. Lumber for exterior wood stain finish, not less than 50 sq. in. (300 sq. cm), for each species, with 1/2 of exposed surface finished.
 - 2. Lumber for transparent finish, not less than 50 sq. in. (300 sq. cm), for each species, with 1/2 of exposed surface finished.
 - 3. Lumber and panel products for shop-applied opaque finish, 8 by 10 inches (200 by 250 mm) for panels and 50 sq. in. (300 sq. cm) for lumber, for each finish system and color, with 1/2 of exposed surface finished.

- D. Product Certificates: For each type of product, signed by product manufacturer.
- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- F. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of exterior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation of exterior woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

- A. Available Fabricators: Subject to compliance with requirements, fabricators offering exterior architectural woodwork that may be incorporated into the Work include, but are not limited to, the following:

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 3. PVC Foamboard:
 - A. Product: Koma by Kommerling or architecture approved equal.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Nonpressure Process: Comply with AWPA N1 using the following preservative for woodwork items indicated to receive water-repellent preservative treatment:
 - 1. Water-Repellent Preservative: Formulation made specifically for dip treatment of woodwork items and containing 3-iodo-2-propynyl butyl carbamate (IPBC) complying with AWPA P8 as its active ingredient.
- B. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood) and the following:
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.
 - 3. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- C. Extent of Treatment: Treat blocking and nailers by pressure process and treat other exterior architectural woodwork either by pressure or nonpressure process.
 - 1. Items fabricated from the following wood species need not be treated:
 - a. African mahogany.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated or required by code, provide materials that comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood), exterior type.
 - 1. Fire-Retardant Chemicals: Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 2. Mill lumber before treatment and implement special 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.
 - 3. Kiln-dry materials before and after treatment to levels required for untreated materials.
 - 4. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - 5. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

2.5 INSTALLATION MATERIALS

- A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, pressure-preservative treated, fire-retardant treated, kiln dried to less than 15 percent moisture content.
- B. Nails: hot-dip galvanized.
- C. Screws: hot-dip galvanized or stainless steel.
 - 1. Provide self-drilling screws for metal framing supports, as recommended by metal-framing manufacturer.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts, unless otherwise indicated. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.6 FABRICATION, GENERAL

- A. Wood Moisture Content: 9 to 15 percent.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.6 mm).
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and seal with a water-resistant coating suitable for exterior applications.

2.7 EXTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Backout or groove backs of flat trim members, and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- C. Assemble casings in plant except where shipping limitations require field assembly.
- D. Wood Species: Any closed-grain hardwood.
 - 1. Do not use plain-sawn lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.

2.8 EXTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.
 - 1. Do not use plain-sawn lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.

2.9 EXTERIOR ORNAMENTAL WORK FOR OPAQUE FINISH

- A. Exterior ornamental work for opaque finish includes the following:
 - 1. Balustrades.
- B. Grade: Custom.
- C. Wood Species: Any closed-grain hardwood.
 - 1. Do not use plain-sawn lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.

2.10 SHOP PRIMING

- A. Woodwork for Opaque Finish: Shop prime woodwork for paint finish with one coat of wood primer specified in Division 09 painting Sections.
- B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with same grade specified in Part 2 for type of woodwork involved.
- B. Install woodwork true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. 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.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- H. Complete finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail and screw holes with matching filler where exposed.
- I. Refer to Division 09 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; replace woodwork where not possible to repair. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064013

SECTION 072100 - THERMAL 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. This Section includes the following:
 - 1. Perimeter insulation under slabs-on-grade.
 - 2. Cavity-wall insulation.
 - 3. Concealed building insulation.
 - 4. Self-supported, spray-applied cellulosic insulation.
 - 5. Vapor retarders.
 - 6. Sound attenuation insulation.
- B. Related Sections include the following:
 - 1. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
 - 2. Division 09 Section Gypsum Board for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
 2. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

2.3 GLASS-FIBER BOARD INSULATION

- A. Available Manufacturers:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Fiber Glass.
 4. Owens Corning.
- B. Foil-Faced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA or ASTM C 553, Types I, II, and III; faced on 1 side with foil-scrim-kraft vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
1. Nominal density of not less than 1.5 lb/cu. ft. (24 kg/cu. m) nor more than 1.7 lb/cu. ft. (27 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
- C. Foil-Faced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; faced on 1 side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
1. Nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).

2.4 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

B. Unfaced, Glass-Fiber 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; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
2. 5-1/2 inches (140 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).

2.5 LOOSE-FILL INSULATION

A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application at attic area; with maximum flame-spread and smoke-developed indexes of 5 at attic area.

2.6 SPRAY-APPLIED CELLULOSIC INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149

1. Corbond or architect approved equal.
 - a. Closed cell.

2.7 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

- D. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.8 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.9 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Available Products:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 - 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) 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 (38 mm) square or in diameter.
 - 1. Available Products:
 - a. AGM Industries, Inc.; RC150.
 - b. AGM Industries, Inc.; SC150.
 - c. Gemco; Dome-Cap.
 - d. Gemco; R-150.
 - e. Gemco; S-150.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

- a. Crawlspace.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. Where indicated.
- C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch (25 mm) unless noted otherwise between face of insulation and substrate to which anchor is attached.
1. Available Products:
 - a. Gemco; Clutch Clip.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Available Products:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches (610 mm) 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 indicated.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.6 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder in location indicated of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation 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 cavity, 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 (76-mm) clearance of insulation around recessed lighting fixtures.
 4. 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
- E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- F. Place loose-fill insulation into spaces indicated, by machine blowing, to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
1. For cellulosic-fiber loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."
- G. Apply self-supported, spray-applied cellulosic insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it flush with face of studs by using method recommended by insulation manufacturer.
- H. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.7 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (400 mm) o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.8 PROTECTION

- A. Protect installed insulation and vapor retarders 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 072100

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) 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. This Section includes the following:
 - 1. Adhered membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 07 Section "Thermal Insulation" for insulation beneath the roof deck.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
 - 4. Division 07 Section "Joint Sealants."

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

- 1. Fire/Windstorm Classification: Class 1A-60.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
- C. Samples for Verification: For the following products:
 - 1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- H. Research/Evaluation Reports: For components of membrane roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.
- K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. 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 warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.
- C. Source Limitations: Obtain components for membrane roofing system approved by roofing membrane manufacturer.
- D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
- E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.
- F. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck

- Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roofing accessories vapor retarder and other components of membrane roofing system.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:
1. Available Manufacturers:
 - a. Carlisle SynTec Incorporated.
 - b. Celotex Corporation.
 - c. ERSystems.
 - d. Firestone Building Products Company.
 - e. GenFlex Roofing Systems.
 - f. International Diamond Systems.
 - g. Johns Manville International, Inc.
 - h. Mule-Hide Products Co., Inc.
 - i. Protective Coatings, Inc.
 - j. Roofing Products International, Inc.
 - k. Stafast Roofing Products.
 - l. Versico Inc.
 2. Thickness: 60 mils (1.5 mm), nominal.
 3. Exposed Face Color: Black.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Cold Fluid-Applied Membrane Adhesive: Manufacturer's standard cold fluid-applied bonding adhesive formulated to adhere fleece-backed roofing membrane to substrate.
- E. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- I. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, prepunched.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 - 1. Available Manufacturers:
 - a. AlliedSignal Inc.; Commercial Roofing Systems.
 - b. Apache Products Company.
 - c. Atlas Roofing Corporation.
 - d. Carlisle SynTec Incorporated.
 - e. Celotex Corporation.
 - f. Firestone Building Products Company.
 - g. GAF Materials Corp.
 - h. GenFlex Roofing Systems.
 - i. Hunter Panels, LLC.
 - j. Johns Manville International, Inc.

- k. Koppers Industries.
- l. RMAX.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.
- D. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of 0.031 inch (0.8 mm) thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions.

3.3 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- E. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a cold fluid-applied adhesive.
 - 2.

3.4 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's

written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

- G. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- I. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for

deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 076200 - 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. This Section includes the following sheet metal flashing and trim:
 - 1. Manufactured through-wall flashing.
 - 2. Formed roof flashing and trim.
 - 3. Formed wall flashing and trim.
 - 4. Formed equipment support flashing.
 - 5. Down Spouts.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
 - 2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 3. Division 07 Section "EPDM" for installing sheet metal flashing and trim integral with roofing membrane.
 - 4. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 5. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - 1. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist

rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
1. Identify material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, closures, and other attachments.
 2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.
- B. Lead-Coated Copper Sheet: ASTM B 101, Temper H00 and H01, cold-rolled copper sheet, of weight (thickness) indicated below, coated both sides with lead weighing not less than 12 lb/100 sq. ft. (0.59 kg/sq. m) nor more than 15 lb/100 sq. ft. (0.73 kg/sq. m) of copper sheet (total weight of lead applied equally to both sides).

- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Mill Finish: Standard one-side bright.
 2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
 3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.
- D. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.
- E. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
- F. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 2. Exposed Finishes: Apply the following coil coating:
 - a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a) Humidity Resistance: 2000 hours.
 - b) Salt-Spray Resistance: 2000 hours.
 - 2) Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil

(0.038 mm); complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

- 3) Color: As selected by Architect from manufacturer's full range.

- G. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
 2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- E. Burning Rod for Lead: Same composition as lead sheet.
- F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- K. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- L. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Fabricate downspouts from the following material:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.

2.5 ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:
 - 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- B. Drip Edges: Fabricate from the following material:
 - 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- C. Counterflashing: Fabricate from the following material:
 - 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- D. Roof-Penetration Flashing: Fabricate from the following material:
 - 1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2.6 SHEET METAL FABRICATIONS AT CANOPY

- A. Metal cover: Fabricate from the following material:
 - 1. Copper: 16 oz./sq. ft. (0.55 mm thick).
- B. Down spouts:

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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of uncoated aluminum stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.

- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Aluminum: Use aluminum or stainless-steel fasteners.
 - 3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
 - 4. Stainless Steel: Use stainless-steel fasteners.
- G. Seal joints with butyl sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pre-tinned surface would show in finished Work.
 - 1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
 - 2. Pre-tinning is not required for lead-coated copper.
 - 3. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
 - 4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
 - 5. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
 - 6. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

- B. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 - 1. Provide elbows at base of downspout to direct water away from building.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for butyl sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Manufactured Hanger Style: Chosen from all of manufacturer's options.
 - 2. Fabricate downspouts from the following material:
 - a. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.
 - b. Color: Chosen from all of manufacturer's options.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with sealant to equipment support member.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - 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. This Section includes the following:
 - 1. Eave vents.
 - 2. Roof hatches.
 - 3. Roof vents.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Division 06 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- C. 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.
- D. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.
- E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

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.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

1.8 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.

- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.
 - 3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2604, except as modified below:
 - 1) Humidity Resistance: 1000 hours.
 - 2) Salt-Spray Resistance: 1000 hours.
- D. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and mill finish:
 - 1. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturer's written instructions.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.
- E. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
- F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
- G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
- I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- J. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.3 MISCELLANEOUS MATERIALS

- A. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, 1 inch (25 mm) thick.
- B. Glass-Fiber Board Insulation: ASTM C 726, 1 inch (25 mm) thick.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch (25 mm) thick.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWWA C2; not less than 1-1/2 inches (38 mm) thick.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Polyethylene Sheet: 6-mil- (0.15-mm-) thick, polyethylene sheet complying with ASTM D 4397.
- G. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- H. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- J. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- K. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
- L. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 EAVE VENTS

- A. 3 inch round, 2 square inches net free-vent area.
- B. Fire stopping.

2.5 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with

welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Available Manufacturers:
 - a. Babcock-Davis; a Cierra Products Inc. Company.
 - b. Bilco Company (The).
 - c. Bristolite Skylights.
 - d. Custom Curb, Inc.
 - e. Dur-Red Products.
 - f. Hi Pro International, Inc.
 - g. J. L. Industries, Inc.
 - h. Metallic Products Corporation.
 - i. Milcor Inc.; a Gibraltar Company.
 - j. Nystrom, Inc.
 - k. O'Keeffe's Inc.
 - l. Precision Ladders, LLC.
 - m. Roof Products & Systems Corporation.
 - n. ThyCurb; Div of Thybar Corporation.
 - o. Wasco Products, Inc.
 - p. Western Canwell.

2. Loads: Fabricate roof hatches to withstand loads as per structural drawings external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
3. Type and Size: Single-leaf lid, 30 by 36 inches (750 by 900 mm).
4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch (2.0 mm) thick.
5. Insulation: Cellulosic-fiber board.
6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
8. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
9. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height constant.
10. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

11. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
 - a. Test Load: as per OSHA.
 - b. Height: 42 inches (1060 mm) above finished roof deck.
 - c. Material and Finish: Steel tube, galvanized.
 - d. Diameter: Pipe with 1-5/8-inch (41-mm) OD tube.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 - 2. Verify dimensions of roof openings for roof accessories.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of 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 underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
 - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 - 2. Attach safety railing system to roof hatch curb.
 - 3. Attach ladder safety post according to manufacturer's written instructions.
- F. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 078413

THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:

1. Floors.
2. Roofs.
3. Walls and partitions.
4. Smoke barriers.
5. Construction enclosing compartmentalized areas.

- B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for construction of openings in concrete slabs and walls.
2. Division 7 Section "Thermal Insulation" for safing insulation and accessories.

1.03 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

- C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

- D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
 - 4. Products in public areas shall be paintable.
- E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.
- F. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Product Data: For each type of through-penetration firestop system product indicated. List product characteristics, typical uses, performance and limitation criteria, and test data.
 - 1. Include manufacture's installation procedures for each type of product.
- C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
 - 3. For those firestop applications that exist for which no UL tested system is available through a manufacturer, manufacturer's engineering judgement derived from similar UL system design or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Manufacturer's engineering judgement shall follow the requirements set forth by the International Firestop Council.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- E. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- F. Product Test Reports: From an independent qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests shall be performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in "Fire Resistance Directory."
 - 2) ITS in "Directory of Listed Products."
- D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- E. Field-Testing: Each type of through-penetration firestop system shall be field-tested.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

- A. Coordinate the Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a smoke- and fire-resistant installation.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- D. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bio Fireshield, Carlisle, MA.
 - 2. W. R. Grace & Co., Construction Products Division.
 - 3. Hilti Construction Chemicals, Inc.
 - 4. Isolatek International.
 - 5. Nelson Firestop Products.
 - 6. Specified Technologies Inc.
 - 7. 3M Fire Protection Products.

2.02 FIRESTOPPING, GENERAL

- A. Firestop Systems: All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire-resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
 - 1. Provide paintable firestop products at locations exposed to the public. Mechanical, electrical and elevator machine rooms are not considered public spaces.
- B. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

- C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the UL or Warnock Hersey tested assembly.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
1. Product:
 - a. CP 680 Cast-In-Place Firestop Device; Hilti Construction Chemicals, Inc.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
1. Product:
 - a. Biostop 500+ Intumescent Firestop; Bio Fireshield.
 - b. FlameSafe FS900 Sealant; W. R. Grace & Co.
 - c. Fire Barrier CP 25WB+; 3M Fire Protection Products.
 - d. SpecSeal LC 150 Sealant; Specified Technologies Inc.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
1. Product:
 - a. Biostop Pipe Collar; Bio Fireshield.
 - b. FlameSafe FSWS Series FlameSafe Devices; W. R. Grace & Co.
 - c. CP 642 and CP 643 Firestop Jacket; Hilti Construction Chemicals, Inc.
 - d. SpecSeal Series LCC and Series SSC Firestop Collars; Specified Technologies Inc.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
1. Product:
 - a. Biostop Composite Sheet; Bio Fireshield.
 - b. CS-195 Composite Sheet; 3M Fire Protection Products.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
1. Product:

- a. FlameSafe FSP 1000 Putty and FSP 1077 Putty Pads; W. R. Grace & Co.
 - b. CP 617 and CP 618 Putty Pads and Putty Sticks; Hilti Construction Chemicals, Inc.
 - c. MPS-2 Moldable Putty Stix and Putty Pads; 3M Fire Protection Products.
 - d. Spec-Seal Firestop Putty Bars and Putty Pads; Specified Technologies Inc.
- G. Intumescent Wrap Strips with Foil: Single-component intumescent elastomeric sheets with aluminum foil on one side.
1. Product:
 - a. CP 645 Wrap Strips; Hilti Construction Chemicals, Inc.
 - b. Fire Barrier FS-195+ Wrap Strip; 3M Fire Protection Products.
- H. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets.
1. Product:
 - a. Biostop Wrap Strip; Bio Fireshield.
 - b. SpecSeal Series SSWBLU and Series SSWRED Intumescent Wrap; Specified Technologies Inc.
- I. 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.
1. Product:
 - a. FlameSafe Mortar Safe; W. R. Grace & Co.
 - b. CP 636 Firestop Mortar; Hilti Construction Chemicals, Inc.
 - c. SpecSeal Firestop Mortar; Specified Technologies Inc.
- J. 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.
1. Product:
 - a. Bio Firestop Pillows; Bio Fireshield.
 - b. FlameSafe Bags and FlameSafe Pillows; W. R. Grace & Co.
 - c. CP 651 Firestop Cushion; Hilti Construction Chemicals, Inc.
 - d. SpecSeal Firestop Pillows; Specified Technologies Inc.
- K. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
1. Product:
 - a. CP 620 Firestop Foam; Hilti Construction Chemicals, Inc.
 - b. Fire Barrier 2001 Silicone RTV Foam; 3M Fire Protection Products.
 - c. SpecSeal Pen 200 Silicone Foam; Specified Technologies Inc.
- L. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - a. Product:
 - 1) Biotherm 200SL Firestop Sealant; Bio Fireshield.
 - 2) CP 604 Self-Leveling Firestop Sealant; Hilti Construction Chemicals, Inc.
 - 3) Fire Barrier 1003SL; 3M Fire Protection Products.
 - 4) SpecSeal Pen 300 Silicone Sealant; Specified Technologies Inc.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - a. Product:
 - 1) Biotherm 200SL Firestop Sealant; Bio Fireshield.
 - 2) CP 604 Self-Leveling Firestop Sealant; Hilti Construction Chemicals, Inc.
 - 3) Fire Barrier 1003SL; 3M Fire Protection Products.
 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
 - a. Product:
 - 1) Biotherm 100 Firestop Sealant; Bio Fireshield.
 - 2) CP 601S Elastomeric Firestop Sealant; Hilti Construction Chemicals, Inc.
- M. Accessories: Forming/damming materials composed of mineral fiberboard or other type as recommended by through-penetration firestop systems manufacturer.

2.04 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop 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

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. 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 through-penetration firestop 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 through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to

remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
 - 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop 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 through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new

materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Construction and control joints in cast-in-place concrete.
 - b. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - c. Control joints in ceilings and other overhead surfaces.
 - d. Other joints as indicated.
 - 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - d. Other joints as indicated.
 - 4. Interior joints in the following horizontal traffic surfaces:
 - a. Isolation and control joints in exposed cast-in-place concrete slabs.
 - b. Other joints as indicated.
- B. Related Sections include the following:
 - 1. Division 2 Sections for sealing joints in pavements, walkways, and curbing.
 - 2. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for sealing joints related to flashing.
 - 4. Division 7 Section "Through-Penetration Firestop Systems" for sealing penetrations in fire-resistance-rated construction.
 - 5. Division 8 Section "Glazing" for glazing sealants.
 - 6. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 7. Sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Product Data: For each joint-sealant product indicated.
- C. Samples for 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. Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in materials, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, shelf/pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

1.07 PROJECT CONDITIONS

- A. Environmental Conditions: 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. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

PART 2 - PRODUCTS

2.01 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 sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 JOINT SEALANTS

- A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25; single component.
 - 1. Sonolastic NP-1; Sonneborn, Division of ChemRex Inc.
 - 2. Dymonic; Tremco, Inc.
 - 3. Sikaflex-1a; Sika Corporation, Inc.
 - 4. Dynatrol 1; Pecora Corporation.
 - 5. Vulkem 116; Tremco, Inc.
 - 6. Chem-Calk 900; Bostik Findley.
- B. Type 2 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type M, Grade NS, Class 25; two-component.
 - 1. Sonolastic NP-2; Sonneborn, Division of ChemRex Inc.
 - 2. Dymeric 240/240FC; Tremco, Inc.
 - 3. Sikaflex-2c, NS; Sika Corporation, Inc.
 - 4. Dynatrol 2; Pecora Corporation.
 - 5. Vulkem 922; Tremco, Inc.
 - 6. Chem-Calk 500; Bostik Findley.
- C. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - 1. Tremflex 834; Tremco, Inc.
 - 2. AC-20; Pecora Corporation.
 - 3. Chem-Calk 600; Bostik Findley.
- D. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
 - 1. Sanitary SCS 1700; GE Silicones.
 - 2. 898 Silicone; Pecora Corporation.
 - 3. 786 MR Silicone; Dow Corning Corporation.
 - 4. Tremsil 200; Tremco, Inc.
- E. Type 5 - Acoustical Sealant: Specified in Section 09260.
- F. Type 6 - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.

1. Sonolastic SL-1; Sonneborn, Division of ChemRex Inc.
2. Sikaflex-1CSL; Sika Corporation, Inc.
3. Vulkem 45/45SSL; Tremco, Inc.

2.03 JOINT-SEALANT BACKING

- A. General: Provide sealant backings (backer rods) of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers (Backer Rods): Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean concrete, masonry unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form-release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where indicated or recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Installation of Sealant Backings (Backer Rods): Install sealant backings to comply with the following requirements:
1. Install sealant backings of type indicated to provide support of sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 2. Install bond-breaker tape behind sealants where sealant backings (backer rods) are not used between sealants and backs of joints.
- D. Installation of Sealants: Install sealants using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

- A. Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work: Type 2; colors as selected.
- B. Exterior Joints Between Precast Concrete Units: Type 2; colors as selected.
- C. Joints between Exterior Metal Frames and Adjacent Work (Except Masonry): Type 2; colors as selected.
- D. Under Exterior Door Thresholds: Type 1.
- E. Concealed Interior Perimeter Joints of Exterior Openings: Type 1.
- F. Exposed Interior Perimeter Joints of Exterior Openings: Type 3; colors as selected.
- G. Interior Ceramic Tile Expansion, Control, Contraction, and Isolation Joints in Horizontal Traffic Surfaces: Type 2; color as selected.
- H. Control and Expansion Joints in Interior Concrete Slabs and Floors Left Exposed: Type 6; colors as selected.
- I. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 4; colors as selected.
- J. Interior Joints for Which No Other Sealant is Indicated: Type 3; colors as selected.

END OF SECTION 07920

SECTION 081113 - 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. Standard hollow metal doors and frames.

B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
- 2. Division 08 Section Door Hardware for door hardware for hollow metal doors.
- 3. Division 09 Sections Exterior Painting for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.

8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

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. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.
 - 4. Curries Company; an Assa Abloy Group company.
 - 5. Deansteel Manufacturing Company, Inc.
 - 6. Firedoor Corporation.
 - 7. Fleming Door Products Ltd.; an Assa Abloy Group company.
 - 8. Habersham Metal Products Company.
 - 9. Karpen Steel Custom Doors & Frames.
 - 10. Kewanee Corporation (The).
 - 11. Mesker Door Inc.
 - 12. Pioneer Industries, Inc.
 - 13. Security Metal Products Corp.
 - 14. Steelcraft; an Ingersoll-Rand company.
 - 15. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) 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.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-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.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 08 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel unless noted otherwise.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors and interior doors where indicated.
 - 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.

- a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as knocked down unless otherwise indicated.
 3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as knocked down unless otherwise indicated.
 3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
 4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 5. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 6. Frames for Borrowed Lights: Same as adjacent door frame.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 CUSTOM HOLLOW METAL DOORS

- A. General: Provide doors not less than 1-3/4 inches (44.5 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861.
- B. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.053 inch (1.3 mm) thick.
- C. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated, minimum 0.042 inch (1.0 mm) thick.
- D. Core Construction: Provide thermal-resistance-rated cores for exterior doors and interior doors where indicated.
 - 1. Steel-Stiffened Core: 0.026-inch- (0.7-mm-) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) when tested according to ASTM C 1363.
- E. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).
- F. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
- G. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch (1.3 mm) thick, of same material as face sheets and spot welded to both face sheets.
- H. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

2.6 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 (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- ((0.5-mm-)) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
 - 3. 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 testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.10 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 thickness of metal. 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. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.
- C. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
 3. 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 (19 mm) beyond edge of door on which astragal is mounted.
- D. 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 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 bottom of jambs and mullions with at least four spot welds per anchor.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - 5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.

- d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 6. Door Silencers: Except on weather-stripped doors, 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.
 - E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
 - F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
 - G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
- 2.11 STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

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. For the record, 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. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. 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 ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.

- b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), 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 Standard Steel Doors:

- a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 08 Section "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 (230 mm) o.c. and not more than 2 inches (50 mm) 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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD 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:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Shop priming flush wood doors.
- B. Related Sections:
 - 1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction louvers, and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.
 - 2. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
 - 3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
 - 2. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 - 3. Provide WI-Certified Compliance Certificate for installation.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

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. Algoma Hardwoods, Inc.
 2. Ampco, Inc.
 3. Buell Door Company Inc.
 4. Chappell Door Co.
 5. Eagle Plywood & Door Manufacturing, Inc.
 6. Eggers Industries.
 7. Graham; an Assa Abloy Group company.
 8. Haley Brothers, Inc.
 9. Ideal Architectural Doors & Plywood.
 10. Ipik Door Company.
 11. Lambton Doors.
 12. Marlite.
 13. Marshfield Door Systems, Inc.
 14. Mohawk Flush Doors, Inc.; a Masonite company.
 15. Oshkosh Architectural Door Company.
 16. Poncraft Door Company.
 17. Vancouver Door Company.
 18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-1.

2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.
3. Pairs: Provide formed-steel edges and astragals.
 - a. Finish steel edges and astragals to match door hardware (locksets or exit devices).

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors

1. Grade: Premium, with Grade A faces.
2. Species: Select white birch.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Pleasing match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
9. Exposed Vertical Edges: Same species as faces or a compatible species.
10. Core: Either glued wood stave or structural composite lumber.
11. Construction: Seven plies, either bonded or nonbonded construction.
12. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
- B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 082120 – STILE AND RAIL WOOD DOORS AND WOOD FRAMES

PART 1 – GENERAL

1.01 DESCRIPTION

A. General

1. Furnish all labor, materials, tools, equipment and services for all stile and rail wood doors as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous appurtenance and devices incidental to or necessary for a sound, secure and complete installation.

B. Related work specified elsewhere:

1. Finish hardware – Section 08700
2. Metal doors and frames – Section 08100
3. Glass and glazing – Section 08800

1.02 QUALITY ASSURANCE

A. Manufacturing standards: Architectural Woodwork Institute (AWI) Quality Standards, Section 1400, Premium Grade

B. Fitting Tolerance:

1. 1/8" (3mm) clearance at jambs, heads and meeting stiles
2. 1/2" (12mm) clearance at bottom

1.03 SUBMITTALS

- A. Project Data: Manufacture literature
- B. Shop drawings

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver doors just prior to installation
- B. Identify as to type of location
- C. Provide manufacturer's identifying marks on each door
- D. Store off floor in well ventilated area

1.05 GUARANTEE

A. Guarantee doors in writing for 1 year of installation against defects including:

1. Warp or twist of 1/4" (6mm) or more
2. Surface variations exceeding 1/100" (.4mm) or more in 3 in.

3. Any other defect which may impair or affect performance of the door for purpose for which it is intended
- B. Remove and replace defective doors; removal of defective units, re-hanging and refinishing of replacement units shall be included in the contract

PART 2 – PRODUCTS

2.01 MATERIALS – GENERAL

- A. Acceptable Manufacture:
1. Exterior wood doors:
 - a. East Coast Custom Doors, South Portland, ME or Architect approved equal.
- B. Wood Species
1. Exterior doors: African mahogany
- C. Doors, Stile and Rail
1. Door thickness: 1 ¾”
 2. Stiles and rails to be solid stock lumber
 3. Panels to be fabricated from clear solid stock hardwood, 1 ½” in. thickness, pressure glued
 4. Assembly: Cope and bead joints between stiles and rails with floating tenons
 5. Exterior doors to be finished with KTM Finishes from Grafted Coatings, Inc.
 6. Pattern as indicated on architectural drawings
 7. Paint finish by manufacturer
 8. Match existing true divided sticking for vision kits

2.02 FABRICATION

- A. Factory machine doors for application of hardware
- B. Factory level vertical edges, 1/8” in 2” on lock and butt stile
- C. Seal top and bottom and reseal field cuts
- D. Undercut to be ½” maximum above finished floor or threshold

2.03 WOOD FRAMES

- A. Acceptable Manufacture
1. Wood frames
 - a. East Coast Custom Doors, South Portland, ME or Architect approved equal.
- B. Wood Species

1. Exterior african mahogany
 2. Interior poplar paint grade
- C. Refurbish existing wood frame
1. Door #103A re-condition existing wood frame
Fill existing hardware preps to accommodate new door and hardware
- D. Wood Trim
1. Exterior african mahogany 1 x 3
 2. Interior poplar 1 x 3

PART 3—EXECUTION

3.01. INSPECTION

- A. Verify suitability of openings to accept installation
- B. Installation constitutes acceptance of responsibility for performance

3.02. INSTALLATION

- A. Do not hang damaged, warped or stained doors
- B. Condition doors to prevailing humidity prior to hanging
- C. Fit doors to frames and machine for not previously worked at factory
- D. Install doors in accord with manufacturer's instructions, and as indicated
- E. Adjust for proper fit and uniform clearance

END OF SECTION

SECTION 083113 - ACCESS 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. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
 - 2. Division 07 Section "Roof Accessories" for roof hatches.
 - 3. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

- B. 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 per 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 for vertical access doors and frames.
 - 2. ASTM E 119 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- 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.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- C. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating in damp locations; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a

conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

- a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
- F. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 ALUMINUM MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2 (ANSI H35.2(M)).
1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written specifications for cleaning, conversion coating, and painting.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Acudor Products, Inc.
 2. Babcock-Davis; A Cierra Products Co.
 3. Bar-Co, Inc. Div.; Alfab, Inc.
 4. Cendrex Inc.
 5. Dur-Red Products.
 6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
 7. Jensen Industries.
 8. J. L. Industries, Inc.
 9. Karp Associates, Inc.
 10. Larsen's Manufacturing Company.
 11. MIFAB, Inc.
 12. Milcor Inc.
 13. Nystrom, Inc.
 14. Williams Bros. Corporation of America (The).

- B. Flush Access Doors and Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead flange.
 - 4. Hinges: Spring-loaded, concealed-pin type.
 - 5. Latch: Self-latching bolt operated by screwdriver with interior release.

- C. Fire-Rated, Insulated, Flush Access Doors and Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Fire-Resistance Rating: Not less than that indicated.
 - 3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
 - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
 - 5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
 - 6. Hinges: Concealed-pin type.
 - 7. Automatic Closer: Spring type.
 - 8. Latch: Self-latching device operated by knurled knob with interior release.

2.4 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 panels to types of supports indicated.
 - 1. For trimless frames with drywall bead, provide edge trim for gypsum board 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. Furnish adjustable metal masonry anchors.

- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- 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 083113

SECTION 08 52 13**ALUMINUM CLAD WOOD ULTIMATE DOUBLE HUNG WINDOW****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Aluminum clad wood ultimate double hung windows complete with hardware, glazing, weather strip, insect screen, simulated divided lites, and standard or specified anchors, trim, attachments, and accessories.

1.2 RELATED SECTIONS

- A. Section 01 33 23—Submittal Procedures: Shop Drawings, Product Data, and Samples
- B. Section 01 62 00—Product Options
- C. Section 01 65 00—Product Delivery
- D. Section 01 66 00—Storage and Handling Requirements
- E. Section 01 71 00—Examination and Preparation
- F. Section 01 73 00—Execution
- G. Section 01 74 00—Cleaning and Waste Management
- H. Section 07 92 00—Joint Sealants: Sill sealant and perimeter caulking
- I. Section 09 90 00—Paints and Coatings: Paint or stain other than factory applied finish

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. E 283: Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
 - 2. E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtains Walls, and Doors by Uniform Static Air Pressure Difference.
 - 3. E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 - 4. E 774: Specification for Sealed Insulated Glass Units.
 - 5. C 1036: Standard Specification for Flat Glass.
- B. WDMA I.S.4: Industry Standard for Water Repellent Preservative Treatment for Millwork.
- C. American Architectural Manufactures Association / Window and Door Manufactures Association (AAMA / WDMA): ANSI / AAMA / NWWDA 101 / I.S.2-97 Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors. and 101 / I.S.2 / NAFS-02 Voluntary Performance Specification for Windows, Skylights and Glass Doors.

- D. Window and Door Manufacturers Association (WMDA): 101 / I.S.2 WDMA Hallmark Certification Program.
- E. Sealed Insulating Glass Manufactures Association / Insulating Glass Certification Council (SIGMA / IGCC).
- F. American Architectural Manufacturers Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- G. National Fenestration Rating Council (NFRC): 101: Procedure for Determining Fenestration Product Thermal Properties.

1.4 SYSTEM DESCRIPTION

- A. Design and Performance Requirements:
 - 1. Window units shall be designed to comply with ANSI / AAMA / NWWDA 101 / I.S.2-97 and 101 / I.S. 2/ NAFS-02
 - a. Double Hung / Single Hung: (H-LC30
 - 2. Air leakage shall not exceed the following when tested at 1.57 according to ASTM E 283: .30 cfm per square foot of frame.
 - 3. No water penetration shall occur when units are tested at the following pressure according to ASTM E 547: H-LC30 - 4.5 psf.
 - 4. Window assembly shall withstand the following positive or negative uniform static air pressure difference without damage when tested according to ASTM E 330: H-LC30 – 45 psf.

1.5 SUBMITTALS

- A. Shop Drawings: Submit shop drawings under provisions of Section 01 33 23.
- B. Product Data: Submit catalog data under provisions of Section 01 33 23.

1.6 DELIVERY

- A. Comply with provisions of Section 01 65 00.
- B. Deliver in original packaging and protect from weather.

1.7 STORAGE AND HANDLING

- A. Prime or seal wood surfaces, including surface to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.
- B. Store window units in an upright position in a clean and dry storage area above ground and protect from weather under provisions of Section 01 66 00.

1.8 WARRANTY

- A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten (10) years from purchase date.

- B. Insulating glass shall be warranted against visible obstruction through the glass caused by a failure of the insulating glass air seal for a period of twenty (20) years from the date of original purchase.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- A. Description: Clad Ultimate Double Hung as manufactured by Marvin Windows and Doors, Warroad, Minnesota.

2.2 FRAME DESCRIPTION

- A. Finger jointed edge-glued pine head and side jambs with interior clear veneer
 - 1. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication.
 - 2. Water repellent preservative treated in accordance with WDMA I.S.4.
- B. Frame thickness: 11/16 inch (17 mm) head jamb, 1-11/32 inch (34 mm) composite side jamb, 1-7/16 inches (37 mm) sill, 8 degree bevel.
- C. Frame width: 4-9/16 inches (116 mm). Exterior extruded aluminum clad 0.050 inch (1.3 mm) thick.

2.3 SASH DESCRIPTION

- A. Clear pine
 - 1. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication.
 - 2. Water repellent preservative treated in accordance with WDMA I.S.4.
- B. Composite sash thickness: 1-9/16 inches (40 mm) for operating units. Corners slot and tenoned.
- C. Sash exterior extruded aluminum clad 0.045 inch (1.1 mm) thick per drawings
- D. Operable sash tilt to interior for cleaning or removal.

2.4 GLAZING

- A. Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E 774.
- B. Glazing method: Insulated glass; (Altitude adjusted)
- C. Glass type: Clear Low E 272 with Argon gas; Tempered as required by code.
- D. Glazing seal: Silicone bedding on interior; acrylic foam adhesive tape on exterior.

2.5 FINISH

- A. Exterior: Fluoropolymer modified acrylic topcoat applied over fluoropolymer primer. Meets or exceeds AAMA 2605 requirements.
 - 1. Color: as selected by architect from manufacturer's full range.

- B. Interior: Treated bare wood; Latex prime coat, white.

2.6 HARDWARE

- A. Balance system: Coil spring block and tackle with nylon cord and fiber filled nylon clutch.
- B. Jamb carrier: Vinyl extrusion with wood and aluminum inserts. Color: Beige.
- C. Lock: High pressure zinc die-cast cam lock and keeper.
 - 1. Finish: Phosphate coated and electrostatically painted Satin Taupe; Bronze; White; baked enamel
- D. Check rail guide.

2.7 WEATHER STRIP

- A. Operating units: Continuous, leaf weather strip at head jamb parting stop; dual durometer bulb at check rail; foam bulb type dual durometer weather strip on vertical sash edge; dual durometer bulb weather-strip at bottom rail. Color: Beige.
- B. Stationary units: Continuous, bulb weather strip at perimeter of sash, concealed slotted bulb weather strip on exterior of sash, pile weather strip on interior of blind stop, dual durometer bulb weather strip at bottom rail. Color: Beige.

2.8 INSECT SCREENS

- A. Factory installed half screen Half screen covers bottom sash opening. Screen cloth, 18 by 16 mesh: Charcoal fiberglass
- B. Aluminum frame finish:
 - 1. Color: to match exterior aluminum cladding

2.9 SIMULATED DIVIDED LITES (SDL)

- A. 5/8 inch wide; with internal spacer bars
 - 1. Exterior muntins: 0.055 inch (1.4 mm) thick extruded aluminum.
 - 2. Interior muntins: Pine. Muntins adhered to glass with double coated acrylic foam tape.
 - 1. Pattern: Rectangular per drawings
 - 2. Finish: Match sash finish.

2.10 ACCESSORIES AND TRIM

- A. Installation Accessories:
 - 1. Installation brackets: 9-3/8 inches (238 mm)
- B. Aluminum Extrusions:
 - 1. Profile: Special Casing and special sill extrusion as indicated on drawings.
 - 2. Finish: Fluoropolymer modified acrylic topcoat applied over primer. Meets or exceeds AAMA 2605 requirements. a. Color: match exterior color selected by architect.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Before Installation, verify openings are plumb, square, and of proper dimension as required in Section 01 71 00. Report frame defects or unsuitable conditions to the General Contractor before proceeding.
- B. Acceptance of Conditions: Beginning of installation confirms acceptance of existing conditions.

3.2 INSTALLATION

- A. Comply with Section 01 73 00.
- B. Assemble and install window unit according to manufacturer's instructions and reviewed shop drawings.
- C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07920 Joint Sealants. Do not use expansive foam sealant.
- D. Install accessory items as required.

3.3 CLEANING

- A. Remove visible labels and adhesive residue from glass according to manufacture's instructions.
- B. Leave windows and glass in a clean condition. Final cleaning as required in Section 01 74 00.

3.4 PROTECTING INSTALLED CONSTRUCTION

- A. Comply with Section 01 76 00.
- B. Protect windows from damage by chemicals, solvents, paint, or other construction operations that may cause damage.

END OF SECTION

SECTION 087100 – FINISH HARDWARE, ACCESS CONTROL, LOW VOLTAGE WIRING

PART 1 –GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, the following:
 - 1. Providing hardware for all doors, except doors provided with their own hardware.
 - 2. Providing lock cylinders for all work requiring cylinders.
 - 3. Providing the services of a qualified hardware consultant to prepare detailed schedules of hardware required for the project.
 - 4. Provide all low voltage wire and wiring for access control system. Locate card access controller in existing tele data room.

1.03 RELATED WORK

- A. Carefully examine all of the Contrast Documents for requirements which affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 08100 – Hollow metal doors and frames; work requiring template coordination, metal astragals for fire-rated doors.
 - 2. Section 08210 – Wood doors; work requiring template coordination, metal astragals for fire-rated doors.
 - 3. Section 08212 – Stile and rail wood doors and wood frames

1.04 INTENT

- A. A major intent of the work of this section is to provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Provide only hardware that complies with applicable codes and requirements of authorities having jurisdiction including requirements for barrier-free accessibility.

1.05 QUALITY ASSURANCE

- A. Hardware supplier shall have in his employ one or more members of the Door and Hardware Institute to include at least one Certified Architectural Hardware Consultant in good standing, who shall be responsible for preparation of the Finish Hardware Schedule. This Consultant shall be acceptable to the Architect and is to ensure that the intent requirement of this specification is fulfilled, and certify that the work of this section meets or exceeds the requirements specified in this section and the requirements of authorities having jurisdiction.

- B. Hardware supplier shall warrant and guarantee, in writing, that hardware supplied is free of defective material and workmanship. Supplier shall further warrant and guarantee for a period of one year from Owner's Use and Occupancy that the hardware shall function in a satisfactory manner without binding, collapse, or dislodging of its parts, provide the installation is made to the manufacturer's recommendations.
- C. The hardware supplier shall repair or remedy, without charge, any defect of workmanship or material for which he is responsible hereunder.

1.06 SUBMITTALS

- A. Submit the following in accordance with SECTION 01300-SUBMITTALS:
 - 1. Schedule: Submit to the Architect six (6) copies of the complete hardware schedule within the fourteen (14) days after receipt of contract award. Submit therewith complete catalog cuts and descriptive data of all products specifically scheduled therein. No materials shall be ordered or templates issued until the hardware schedule has been approved by the Architect. Form and detail of hardware schedule shall be in vertical format in conformance to the door and hardware industry standards. All hardware sets shall be clearly cross-referenced to the hardware set numbers listed in the specifications.
 - 2. Samples: If requested, submit to the Architect for approval, a complete line of samples as directed. Samples shall be plainly marked giving hardware number used in this specification, the manufacturer's numbers, types and sizes. The Architect will deliver approved samples to the project site to be stored. Samples will remain with the Architect until delivery of all hardware to the project is complete, after which time they will be turned over to the General Contractor for incorporation into the work.
 - 3. Keying System Submission: Before cylinders are ordered, submit a complete proposed keying system for approval. This should be done after a keying meeting has been held with the owner's representative.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of hardware shall be made to the project by the Hardware Supplier in accordance with the instructions of the General Contractor.
- B. The finish hardware shall be delivered to the jobsite and received there by the General Contractor. The General Contractor shall prepare a locked storage room with adequate shelving, for all hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.
- C. The General Contractor shall furnish the Hardware Supplier with receipts for all hardware and accessory items received, and shall send copies of these receipts to the Architect, if requested.

1.08 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. Provide all throws, projections, coatings, knurling, opening and closing forces, and other special functions required by State and Local Building Codes, and all applicable Handicap Code requirements.
- B. For fire rated openings, provide hardware complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.

1.09 SPECIAL REQUIREMENTS

- A. Hardware Supplier shall determine conditions and materials of all doors and frames for proper application of hardware.
- B. The Hardware Schedule shall list the actual product series numbers. Bidders are required to follow the manufacturers' catalog requirement for the actual size of door closers, brackets and holders. All door opening sizes are as noted on the Door Schedule and all hardware shall be in strict accordance with requirements of height, width, and thickness.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Hinges	McKinney Stanley	Scranton, PA New Britain, CT
Locksets	Schlage (No exception)	Colorado Springs, CO
Exit Devices	Von Duprin (No exception)	Indianapolis, IN
Door Closers	LCN (No exception)	Princeton, IL
Door Stop	Glynn Johnson Ives Rockwood	Indianapolis, IN New Haven, CT Rockwood, PA
Card Access System	Synergistics (No exception)	Natick, MA
Push/Pulls	Rockwood Burns Ives	Rockwood, PA Erie, PA New Haven, CT
Protective Plates	Rockwood Burns Ives	Rockwood, PA Erie, PA New Haven, CT

Thresholds/ Weatherstripping/ Rain Drips	NGP Pemko Reese	Memphis, TN Memphis, TN Rosemount, MN
Silencers	Ives Glynn Johnson Rockwood	New Haven, CT Indianapolis, IN Rockwood, PA
Auto Operators	Horton Operators	Corpus Christi, TX

2.02 MATERIALS AND QUALITY

- A. All hardware shall be of the best grade of solid metal entirely free from imperfections manufacturer and finish.
- B. Qualities, weights, and sizes given herein are the minimum that will be accepted. It is the responsibility of the Hardware Supplier to supply the specified size and weight of hardware and the proper function of hardware in each case and to provide UL approved hardware at all fire rated doors.
- C. Provide, as far as possible, locks of one lock manufacturer and hinges of one hinge manufacturer. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operation and functional features.

2.03 HARDWARE DESIGNATIONS

- A. All items of hardware are referenced by manufacturer's names and numbers. The manufacturer's names and numbers are used to define the function, design, and the quality of the material to be supplied.

Substitution of products other than those listed shall be submitted to the Architect at least ten (10) days PRIOR to the bid date. The Architect shall be the sole judge of any proposed substitution.

2.04 TEMPLATES

- A. Hardware supplier shall immediately, but not later than three (3) days after approval of his Schedule by the Architect, furnish the General Contractor with complete template information necessary for the fabrication of doors, frames, etc. No templates shall be furnished prior to the approval of the hardware schedule.

2.05 HARDWARE FOR LABELED FIRE DOORS, EXIT DEVICES AND SMOKE DOORS

- A. Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Labeling and listing by UL Building Materials Directory, for class of door being used will be accepted as evidence of conformance to these requirements. Install minimum latch throw as specified on label of individual doors. Provide hardware listed by UL except where heavier materials, larger sizes, or better grades are specified

herein under paragraph entitled "Hardware Sets". In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements. Specific hardware requirements of door or frame manufacturers which exceed size or weights of hardware herein listed shall be provided with no additional charge.

2.06 KEYS AND KEYING

- A. The hardware supplier shall review the specific hardware functions with the Architect and owner at the time of the keying review, to assure the appropriateness of each of the hardware functions. Failure to make this review does not relieve the hardware supplier from providing the proper functions.
- B. Key System: All cylinders shall be Masterkeyed and/or Grandmaster Keys: Furnish six (6) keys for each set, if required.
 - 1. Master keys, Grandmaster Keys: Furnish six (6) keys for each set, if required.
 - 2. Furnish three (3) change keys for each cylinder keyed differently; six (6) change keys for each set keyed alike, and in sets where only (2) cylinders are keyed alike, four (4) change keys will be required.
 - 3. All keying is to be done at the factory to avoid duplication of the new cylinders.
 - 4. Master Keys shall be sent to the Owner by registered mail, return receipt required.
 - 5. Supply a bitting list for all change keys and master keys to the Owner.
 - 6. All lock cylinders shall be set to Construction key for use by the Contractor during the construction period. Furnish ten (10) Construction keys and two (2) voiding the Construction key feature.

2.07 FASTENERS

- A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation.
- B. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish exposed screws to match the hardware finish, or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.
- C. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners. Do not use thru-bolts unless specifically approved by the Architect.

- D. All hardware shall be installed only with fasteners supplied by manufacturers of specific products.

2.08 PACKING AND MARKING

- A. All hardware shall have the required screws, bolts and fastenings necessary for proper installation and shall be wrapped in the same package as the hardware item for which it is intended and shall match finish of hardware with which to be used.
- B. Each package shall be clearly labeled indicating the portion of the work for which it is intended.

2.09 ENVIROMENTAL CONCERN FOR PACKGING

- A. The hardware shipped to the jobsite is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-degradable packing.

2.10 FINISH HARDWARE DESCRIPTION

- A. Hardware items shall conform to respective specifications and standards and to requirements specified herein.
- B. MATERIALS AND FINISH MATERIALS AND FINISHES SHALL BE:
 - 1. Interior Butts: US26D (BHMA 652)
 - 2. Exterior Geared Hinges US28 (BHMA 628)
 - 3. Door Closers: Sprayed to match hardware finish.
 - 4. Exit Devices: US26D (BHMA 626)
 - 5. Kick, Push Plates: US32D (BHMA 630)
 - 6. All other hardware shall be: US26D (BHMA 626), or as scheduled.
 - 7. Provide 10B finish for all exterior doors.

C. HINGES

- 1. Number of hinges per door, two hinges for doors up to and including five feet in height and an additional hinge for each two and one half feet or fraction thereof.
- 2. Hinges shall be as follows:

Exterior	McKinney	TA2314	4 ½ x 4 ½ NRP
	Stanley	FBB191	4 ½ x 4 ½ NRP
Interior	McKinney	TA2714	4 ½ x 4 ½
	Stanley	FBB179	4 ½ x 4 ½
Elec	McKinney	TA2714-CC4	
	Stanley	CEFBB179	

D. DOOR CLOSERS:

1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
5. Closer arms (and metal covers when specified) shall have a powder coating finish.
6. Provide drop, mounting plates, where required.
7. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
8. All door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
9. Closers shall conform to all applicable code requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
10. Shall be LCN, no exception:

LCN

- | | |
|----------|---|
| Exterior | 4111S-CUSH
4111S-H-CUSH |
| Interior | 4011
4111
4040SE
4000T
4310ME-SF
4040SE-DE |

E. EXIT DEVICES:

1. Shall be Von Duprin, no exception:

Function	Von Duprin
A	CD99NL-OP
B	CD99EO
C	99L-2
D	99L-BE
E	99NL-F
F	99L-F
G	99L-F-BE
H	9927EO
I	9927L
J	9927L-BE
K	CD9927EO x LBR
L	9927L x LBR
M	9927L-BE x LBR
N	CD99271F
O	9927L-F
P	9927L-F-BE
Q	9927EO-F x LBR
R	9927L-F x LBR
S	9927L-F-BE x LBR
T	EL9927TP
U	EL99L-F
V	EL99NL-OP

NOTE: Lever design shall match lock trim

F. HEAVY DUTY LEVER HANDLE CYLINDRICAL LOCKS:

1. Locksets for this project shall be heavy duty cylindrical key-in-lever handle type locksets.
2. Locksets shall be 2 ¾” backset with ½” throw latchbolt, with deadlocking latch, and a cylindrical housing of steel with a zinc dichromate finish.
3. Locksets shall be fastened by thru-bolts, thru the 3 ½” diameter inside rose back plate into the threaded studs in the outside rose back plate. Thru-bolts shall be placed in separate bolt holes, thru the door and outside the cylindrical case at 180 deg. from each other.
4. The inside and outside rose scalps shall be 3 ½” diameter wrought brass or bronze. When assembled, all thru-bolts in the face of the door shall be concealed from view. The lever handles shall be solid cast in the same finish as the rose.

5. Cylinders to be small format interchangeable core Schlage Everest “B” Family Restricted keyway cores and is also completely compatible with Best.
6. The ½’ throw latchbolt shall be listed and approved for use by Underwriters Laboratories.
7. Strikes shall be curved lip ANSI A115.2 4 7/8” x 1 ¼” wrought brass or bronze.
8. The following locksets shall be considered acceptable for this project:

Schlage	“ND” Series	ATH Design	No exception
---------	-------------	------------	--------------
9. Include all permanent and construction cores.
10. Lock functions as indicated in the hardware schedule shall be as follows:

Function	Schlage	
A(Storeroom)	80	
B(Storeroom)	80	(Knurled Outside Lever)
C(Office)	50	
D(Passage)	10	
E(Vestibule)	60	
F(Classroom)	70	
G(Spec Classroom)	71	
H(Privacy)	40	
I(Apt Entrance)	53	
J(Elec)	96PDEU	(Fail Secure w/RX Switch)

G. DEADLOCKS:

Where called for in the hardware sets provide deadlocks as follows:

Function	Schlage
I (Classroom)	63

H. PUSH PLATES, DOOR PULLS, PUSH/PULL BARS:

1. Shall be as manufactured by Rockwood, Burns or Ives.
 - a. Push plates shall be 4” x 16” x .050 thickness unless otherwise listed in hardware sets.

Rockwood	70 Series
Burns	50 Series
Quality	40 Series

- b. Door pulls shall be 1" x 10"

Type A

Rockwood BF157

- c. Push/pull bars

Type A (Wide Stile Doors)

Rockwood BF11147 x T1006 Mounting
 Burns BF26C x 442 x Sim. Mounting as Above
 Quality BF 482 x Sim. Mounting as Above

I. KICK PLATES, ARMOR PLATES, MOP PLATES:

- 1. Kick plates shall be 8 in. high. Armor plates shall be 34 in. high. Mop plates shall be 4 in. high. All plates shall be 2 in. less the width of door. Plates shall be .050 thickness, bevel 4 edges, screws shall be oval head counter-sunk.

J. STOPS

- 1. Shall be furnished at all doors. Wherever and opened door or any item of hardware thereon strikes a wall, at 90 degrees. Provide wall bumpers, unless otherwise indicated in hardware sets.
- 2. Where wall bumpers cannot be effectively used, a floor stop shall be furnished and installed.
- 3. Provide roller bumpers for each door where two doors interfere with each other in swinging.

Manufacturer	Wall Bumpers	Floor Stops	Roller Bumpers
Rockwood	409	440, 442	456
Ives	407 ½	436B, 438B	470 Series
Glynn Johnson	WB 50XT	FB13, FB14	RB-3

- 4. Where overhead stops are listed they shall be the surface mounted type as follows:

Manufacturer	Series
Glynn Johnson	GJ450
Sargent	1540
ABH	4400

K. THRESHOLDS, WEATHERSTRIP, SEAL:

1. Thresholds shall be as detailed and furnished on all doors where shown on drawings. Thresholds shall be aluminum unless otherwise indicated. Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants".
2. Weatherstripping shall be furnished on all exterior doors unless otherwise indicated.

Product	Pemko	Reese	NGP
Threshold	as detailed		
Brush Seal	45062AP	970	A626A
Auto. Door	430CR	330	420
Bottom			
Door Sweep	345AV	353	101AV
Set Astragals	351C x 351CP	95 x 95P	140 x 140P
Astragal	357SP	183S	139SP
Rain Drip	346C	R210A	16A

L. ACCESS CONTROL SYSTEM:

The access control system shall be WAPAC for windows manufactured by Synergistics, Inc. of Natick, MA, no exception. The controller shall be a CC1065NW located in Data Room 010. The readers shall be mag stripe insertion type, appropriate for the particular application and compatible with the University's existing cards.

M. POWER SUPPLY:

Provide Von Duprin PS873.

N. LOW-ENERGY OPERATOR:

Provide Horton 4100LE low energy operator. Push button switches to be wireless type radio control unit. Provide MC-25 interface switch for all operators with card access control.

O. ELECTROMAGNETIC DOOR RELEASES:

Provide wall mounted mag hold opens equal to Rixson model #FM998.

PART 3—EXECUTION

3.01. INSPECTION

1. It shall be the general contractors responsibility to inspect all doors openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

1. All doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturers templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

1. All materials shall be installed in a workmanlike manner following the manufacture's recommended instructions.
2. Exit Devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, lever. Latching mechanism shall also operate freely without friction or binding.
3. Door Closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be shown on the instruction sheets and required by the finish hardware schedule.
4. The adjustments for all door closers shall be the installer's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check valve shall also be adjusted so as the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field from size 2 thru 6. It shall be the installers' responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closed.
5. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.
6. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

3.04 FIELD QUALITY CONTROL

1. Upon completion of the installation of the finish hardware, it shall be the responsibility of the finish hardware supplier to visit the project and to examine the hardware for each door on which he has provided hardware and to verify that all hardware is in proper working order. Should he find items of hardware not operating problem he should make a report, in writing, to the general contractor, advising him of the problem and the measures required to correct the problem.

3.05 PROTECTION

1. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the Architect and owner, the general contractor shall remove the protective material exposing the finish hardware.

3.06 CLEANING

1. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.07 INSTRUCTIONS AND TOOLS

1. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc... for the following operating products.
 - a. Locksets (all types)
 - b. Exit Devices (all types)
 - c. Door Closers

3.08 HARDWARE SETS

1. Each Hardware Set listed below represents the complete hardware requirements for one opening. (Single Door or Pair of Doors). Furnish the quantities required for each set for the work.

HW 1

Doors #103A

Each Leaf Shall Have: Hinges, Exit Device (Function A), Door Closer (Cush N Stop Arm), Weatherstrip, Door Bottom, Door Pull, Everest B-Restricted Keyway (Hardware 10B Finish)

HW 2

Doors #H101A

Each Leaf Shall Have: Hinges, Exit Device (Function V), Power Transfer (EPT-10), Power Supply, Pull, Automatic Operator, Kick Plate, Card Reader with Controller, Everest B-Restricted Keyway, Weatherstrip, Door Bottom, Threshold
(Hardware 10B Finish)

HW 3

Door #002B

Each Leaf Shall Have: Hinges, Exit Device (Function B), Door Closer (Cush N Stop Arm), Weatherstrip, Door Bottom, Threshold, Kick Plate
(Hardware 10B Finish)

HW 4

Doors #002A, 001A, 101B, 201A, 202A, 301A, 302A

Each Leaf Shall Have: Hinges, Exit Device (Function F), Door Closer, Kick Plate, Door Stop, Everest B-Restricted Keyway

HW 4A

Doors #101A

Each Leaf Shall Have: Hinges, Exit Device (Function F), Door Closer, Kick Plate, Door Stop, Magnetic Hold Open, Everest B-Restricted Keyway

HW 5

Doors #H101B

Each Leaf Shall Have: Hinges, Exit Devices (Function O, O), Door Closers, Kick Plates, Door Stops, Magnetic Hold Opens, Everest B-Restricted Keyway

HW 6

Doors #005A, 006A

Each Leaf Shall Have: Hinges, Lockset (Function B), Door Closer, Kick Plate, Door Stop, Everest B-Restricted Keyway

SECTION 088000 - 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. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed entrances.
 - 4. Interior borrowed lites.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As indicated.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick of thickness indicated.
 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. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

- C. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
 - 1. Each color of tinted float glass.
 - 2. Coated vision glass.
 - 3. Insulating glass for each designation indicated.
 - 4. For each color (except black) of exposed glazing sealant indicated.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
 - 1. Coated float glass.
 - 2. Insulating glass.
 - 3. Glazing sealants.
 - 4. Glazing gaskets.
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
 2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
1. 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.
 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 3. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 4. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- H. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
 2. Associated Laboratories, Inc.
- J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.
 - a. Available Products:
 - 1) AFG Industries Inc.; Krystal Klear.
 - 2) Pilkington Building Products North America; Optiwhite.
 - 3) PPG Industries, Inc.; Starphire.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 4. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.
- D. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 1. Neoprene, ASTM C 864.
 2. EPDM, ASTM C 864.
 3. Any material indicated above.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
 1. Neoprene.
 2. EPDM.
 3. Any material indicated above.
- 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.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Select 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 indicated by manufacturer's designations.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:
 - a. Available Products:
 - 1) Dow Corning Corporation; 790.
 - 2) GE Silicones; SilPruf LM SCS2700.
 - 3) Tremco; Spectrem 1 (Basic).
 - 4) GE Silicones; SilPruf SCS2000.
 - 5) Pecora Corporation; 864.
 - 6) Pecora Corporation; 890.
 - 7) Polymeric Systems Inc.; PSI-641.
 - 8) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
 - 9) Tremco; Spectrem 3.
 - b. Type and Grade: S (single component) and NS (nonsag).
 - c. Class: 50.
 - d. Use Related to Exposure: NT (nontraffic).
 - e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of

product manufacturer and referenced glazing publications, to comply with system performance requirements.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.7 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units MG-~~#~~: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements] [Kind HS (heat-strengthened) float glass or Kind FT (fully tempered) float glass where required by code.

- 1. Thickness: 6.0 mm.

2.8 MONOLITHIC WIRED-GLASS UNITS

- A. Reflective and Low-E Insulating-Glass Units:

- 1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
- 2. Interspace Content: Argon.
- 3. Outdoor Lite: Class 1 (clear) float glass.
- 4. Low-E Coating: Sputtered on second surface.
- 5. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. 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. Do not use.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in 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. 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. Install gaskets so they protrude past face of glazing stops.

3.6 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.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

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 the following:
 - 1. Fixed, extruded-aluminum louvers.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Section 085213 – Aluminum Clad Wood Ultimate Double Hung Window.

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. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding 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 on vertical projection of louvers.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Thermal Movements: Provide louvers 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 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 1. For installed louvers and vents indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of metal finish required.
- E. Qualification Data: For professional engineer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.2, "Structural Welding Code--Aluminum."
 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated adjustable louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Louvers:
 - a. Airline Products Co.
 - b. Airolite Company (The).
 - c. American Warming and Ventilating, Inc.
 - d. Arrow United Industries.
 - e. Carnes Company, Inc.
 - f. Cesco Products.
 - g. Construction Specialties, Inc.
 - h. Dowco Products Group; Safe-Air of Illinois, Inc.
 - i. Greenheck.
 - j. Industrial Louvers, Inc.
 - k. Louvers & Dampers, Inc.
 - l. Metal Form Manufacturing Company, Inc.
 - m. NCA Manufacturing, Inc.
 - n. Nystrom Building Products.
 - o. Reliable Products; Hart & Cooley, Inc.
 - p. Ruskin Company; Tomkins PLC.
 - q. Vent Products Company, Inc.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 6 finish.

- F. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use hex-head or Phillips pan-head screws for exposed fasteners, unless otherwise indicated.
- G. 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 per ASTM E 488, conducted by a qualified independent testing agency.
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Maintain equal louver blade spacing to produce uniform appearance.
- E. 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: Exterior flange, unless otherwise indicated.
- F. Include supports, anchorages, and accessories required for complete assembly.
- G. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) 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.
- H. Provide subsills made of same material as louvers for recessed louvers.
- I. 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.

- J. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, FORMED-METAL LOUVERS

A. Horizontal, Drainable-Blade Louver

1. Louver Depth: 4 inches (100 mm).
2. Frame and Blade Material and Nominal Thickness: Galvanized steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.052 inch (1.3 mm) for frames and 0.040 inch (1.0 mm) for blades.
3. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.050 inch (1.3 mm), with grain running parallel to length of blades and frame members.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect and bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind 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: Rewirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening for Galvanized Steel Louvers:

1. Bird Screening: Galvanized steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.7 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
- B. Powder-Coated Finish: Prepare, treat, and coat galvanized metal louvers to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare louvers by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - 2. Treat prepared louvers with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
 - 4. Color and Gloss: As selected by Architect from manufacturer's full range.

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.
 - 1. 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 and vents 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. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents 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 089000

SECTION 092600

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels.
 - 3. Gypsum board shaft wall assemblies.
 - 4. Acoustical insulation and sealants.
 - 5. Non-load-bearing steel framing.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealants not covered by work of this Section.

1.03 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

Firestopping: For each joint condition where fire-rated walls and partitions interface other walls, floors, structural members or other building structure, provide UL firestop system description and drawing. Show each kind of construction condition and relationships to adjoining construction. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include UL firestop design designation that evidences compliance with requirements for each condition.

1.05 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory," GA-600, "Fire Resistance Design Manual," or in listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Deflection Firestop Track: Top runner indicated in fire-resistance-rated assemblies shall be labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Source Limitations for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single source from a single manufacturer.
 - C. Source Limitations for Panel Products: Obtain each type of gypsum board and other panel products from a single source from a single manufacturer.
 - D. Source Limitations for Finishing Materials: Obtain finishing materials from either manufacturer supplying gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
 - E. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockup using room designated by Architect to demonstrate aesthetic effects and qualities of materials and execution.
 1. Install mockups for surfaces indicated to receive nontextured paint finishes.
 2. Simulate finished lighting conditions for review of mockups.
 3. Mockup will be painted under Division 9 Section "Painting" to provide finished condition for viewing.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to on leveled supports off floor or slab prevent sagging.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products 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.
- D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.

- E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Manufacturers:
 - a. Dale Industries, Inc. - Dale/Incor.
 - b. Dietrich Industries, Inc.
 - c. MarinoWare; Division of Ware Industries.
 - d. National Gypsum Company.
 - e. Unimast, Inc.
- B. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, not less than 0.1620-inch- diameter (8-gage) wire, or double strand of not less than 0.099-inch- diameter (12-gage) wire.
- C. Hanger Attachments to Concrete: As follows:
 - 1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As follows:
 - 1. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.162-inch (8-gage) diameter.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653, G40, hot-dip galvanized zinc coating.
 - 1. Depth: As indicated.
- F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653, G40, hot-dip galvanized zinc coating.
 - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0312 inch (22 gage).
- G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock, heavy-duty.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.

- b. Chicago Metallic Corporation; Drywall Furring 640 System.
- c. USG Interiors, Inc.; Drywall Suspension System.
- d. Provide comparable system where fire-rated ceilings are indicated.

2.03 STEEL PARTITION AND SOFFIT FRAMING

- A. Manufacturers:
 1. Dale Industries, Inc. - Dale/Incor.
 2. Dietrich Industries, Inc.
 3. MarinoWare; Division of Ware Industries.
 4. National Gypsum Company.
 5. Unimast, Inc.
- B. Components, General: As follows:
 1. Comply with ASTM C 754 for conditions indicated.
 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G40, hot-dip galvanized zinc coating.
- C. Steel Studs and Runners: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.027 inch (22gage) minimum, unless otherwise indicated.
 - a. Provide studs with 0.0329 inch (20-gage) minimum thickness at the following locations:
 - 1) For 6 inch or greater framing.
 - 2) Jamb studs for door openings.
 - 3) At locations to receive abuse-resistant board.
 - 4) Where indicated.
 - b. Provide studs with recognizable identifier on surface so different gages installed in walls can be easily identified.
 2. Depth: As indicated.
 3. Maximum Allowable Deflection: Increase metal thickness where required to meet the following:
 - a. Maximum Allowable Deflection for Drywall Assemblies: $L/240$ calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
 - b. Maximum Allowable Deflection for Drywall Assemblies Receiving Tile: $L/360$ calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
- D. Deep-Leg Deflection Track: ASTM C 645 top runner with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
- E. Firestop Deflection Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide deflection track with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
 1. Product: Subject to compliance with requirements, provide the following:
 - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base Metal Thickness: 0.0598 inch (16-gage), unless indicated otherwise.

- G. Cold-Rolled Channel Bridging: 0.0538-inch (16-gage) minimum bare steel thickness, with minimum 1/2-inch- wide flange.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0312 inch (20 gage).
 - 2. Depth: 7/8 inch, unless otherwise indicated.
- I. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, 20 gauge, .0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.
- J. Deflection Brackets:
 - 1. Construction: Slotted galvanized steel angle with step bushing to prevent over tightening of fasteners.
 - 2. Vertical Deflection: 1-1/2 inch total travel.
 - 3. Product: VertiClip; Signature Industries, (919) 844-0789.
 - a. Series: SL, SDL, SLB, and SLS as required by attachment condition.
- K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

2.04 INTERIOR GYPSUM WALLBOARD

- A. Manufacturers:
 - 1. G-P Gypsum Corporation.
 - 2. National Gypsum Company.
 - 3. United States Gypsum Company.
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- C. Gypsum Wallboard (GPDW & GWB): ASTM C 36.
- D. Install interior gypsum board in the following locations:
 - 1. Type X: Everywhere unless otherwise indicated.
 - 2. Flexible Type: Apply in double layer at curved assemblies.
 - 3. Abuse-Resistant Type: In stairwells.
 - 4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- E. Moisture-Resistant Gypsum Board (MR GPDW & MR GWB): ASTM C 630.
 - 1. Type X:
 - a. Thickness: 5/8 inch, unless otherwise indicated.
 - b. Long Edges: Tapered.
 - c. Location: All toilet rooms, except as otherwise noted, and other locations where indicated.
- F. Glass-Mat, Water-Resistant Tile Backing Board: ASTM C 1178.
 - 1. Product: Dens-Shield Tile Backer; G-P Gypsum Corp.
 - 2. Core: 5/8 inch, Type X.

3. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
 4. Locations: Behind tile in tiled showers.
- G. Impact- and Penetration-Resistant Gypsum Wallboard: ASTM C 630 and C 1396, Type X; gypsum core wall panel with additives to enhance fire- and mold/mildew-resistance of core; surfaced with abrasion-, moisture-, and mold/mildew-resistant paper on the front, back and long edges; with a fiberglass mesh embedded in the board to enhance impact/penetration resistance.
1. Products:
 - a. Hi-Impact Brand XP Fire-Shield Wallboard; National Gypsum Company.
 - b. Fiberock Brand VHI Abuse-Resistant Gypsum Fiber Interior Panels; United States Gypsum Co.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered.
 4. Surface Abrasion Resistance: ASTM D 4977 (Modified), not greater than 0.284 inch depth when tested at 50 cycles.
 5. Indentation Resistance: ASTM D 5420, not greater than 0.16 inch depth when tested at an impact load of 72 in.-lbs.
 6. Impact/Penetration Resistance: ASTM E 695, not less than 480 ft.-lbs required to penetrate when using a weight of 60 lbs.
 7. Mold/Mildew Resistance: ASTM D 3273, not less than 8.
 8. Location: Where indicated.

2.05 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

- A. General: Provide assemblies constructed of proprietary gypsum liner panels inserted between steel tracks at each end of studs; with specially shaped steel studs engaged in tracks and fitted between gypsum liner panels; and with gypsum board on finished side or sides applied to studs in the number of layers, thicknesses and arrangement indicated.
- B. Partition Framing: ASTM C 645, manufacturer's standard stud profile, hot-dip galvanized, for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
1. Depth: As indicated.
 2. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.
 3. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated, but not less than 0.0359 inch (20 gage).
 4. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - a. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Cavity Insulation: Provide sound-attenuation blankets in cavity formed by studs between shaft-wall liner panels and room-side finish.

- E. Finishes:
 - 1. Room-Side: As indicated.
 - 2. Shaft Side: Provide only where finish is indicated on shaft side as well as room side, otherwise leave liner panel exposed.

2.06 STRUCTURAL PANEL FLOOR/CEILING SYSTEM

- A. Floor framing-cold formed steel with minimum G-60 galvanized coating, minimum 18 gauge meeting AISI and ASTM specifications and requirements for use in a structural floor system.
- B. Floor Sheeting - 3/4" FORTACRETE Structural Panels manufactured by United States Gypsum Company or architectural approved equal.
- C. Fasteners:
 - 1. Screws-self drilling tapping screws meeting the SAE standard J78. 1013-1022 steel wire, 8-18 x 1-5/8" with minimum 0.250" bugle head design.
 - 2. Screws must be capable of bending 15 degrees without sign of fracture, have a torsion strength of 42 inch-lbs per SAE J81, meet SAE J78 for hardness.
 - 3. Screws must have a corrosion resistance that sustains 250 hours of ASTM B117 salt spray test prior to development of white corrosion products.
 - 4. Location: Raised floor at Lecture Hall.

2.07 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047, galvanized steel.
 - 1. Shapes:
 - a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
 - b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges and where indicated.
 - e. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
- B. Exterior Trim: ASTM C 1047.
 - 1. Material: Hot-dip galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated.

2.08 ACOUSTICAL SEALANT

- A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Pecora Corp.; AIS-919.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
- 2.09 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Fastening gypsum board to steel members: Type S bugle head.
- C. Sound Attenuation Blankets (Acoustical Insulation): 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. Manufacturers:
 - a. Certainteed.
 - b. Owens Corning.
 - c. Johns Manville.
- D. Insulation Support Anchors: Insul-Fast 25 gauge galvanized continuous metal support strip with pre-punched tabs at 8 inches on center.
- E. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."
- F. Firestopping: See Division 7 Section "Through-Penetration Firestop Systems." Provide firestopping where fire rated gypsum board assemblies butt masonry, steel deck, joists, beams, and structural members as part of the gypsum board assembly work. Penetrations through fire-resistance-rated walls and partitions by Division 15 and 16 work, including both empty openings and openings containing cables, pipes, ducts and conduits are specified as part of the Division 15 and 16 work.

PART 3 - EXECUTION

3.01 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.
- 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.
- D. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
 - 1. Touch-up visible gypsum board imperfections before priming of walls.
 - 2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
 - 3. Joint compound touch-up shall be primed and painted before final coat is applied and viewed for acceptability.

3.02 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.03 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
 - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
 - a. Allow for 3/4-inch deflection at floors and 1-1/2 inches at roofs.
 - b. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.
 - c. Install deflection firestop track top runner at fire-resistance-rated assemblies.
 - 1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.04 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling 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 ceiling suspension system. 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 the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing with hangers used for support.
- D. For exterior soffits, install cross bracing and framing to resist wind uplift.
- E. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
- F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- G. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
 - 1. Fire-Rated Ceilings:
 - a. Butt Joints: Provide extra cross tees spaced 8 inches or less on either side of butt joints.
 - b. Fire Relief Notch: Provide a hanger wire installed adjacent to fire relief notch.

3.05 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue

framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at the following spacings:

1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
2. Multilayer Construction: 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

1. Attach both flanges to floor runner track with screws.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. 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.

1. Install two studs at each jamb, unless otherwise indicated.
2. 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.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above, even when partitions are not full height. Provide diagonal bracing at tall partitions to stop deflection and vibration of studs when doors are slammed shut.
4. Extend jamb studs one-piece full height.

G. 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.

H. Frame chase walls and double stud party walls to indicated widths. Provide 2-1/2 inch steel stud cross bracing, spaced maximum 48 inches on center.

3.06 INSTALLATION OF ACOUSTICAL INSULATION

A. Install acoustical insulation at locations indicated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.

C. Hold batt insulation in place with insulation support anchors located at 5 feet on center, full height of wall, starting at the top of each stud space.

D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf).

3.07 INSTALLATION OF GYPSUM BOARD SHAFT-WALL ASSEMBLIES

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 for installing steel framing.
- B. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
- D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators and similar items.
 - 1. See Division 7 Section "Through-Penetration Firestop Systems" for treatment of space around perimeter of penetration.
- E. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- F. Install control joints to maintain fire-resistance rating of assemblies.
- G. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

3.08 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.
- B. Install acoustical insulation, where indicated, before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum 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.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.
 - 1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to installation.
- I. Cover both faces of steel stud partition 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 coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant. Caulk smoke partitions to prevent the passage of smoke.
- J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
- M. Remove screws that do not hit studs, supports, or blocking.

3.09 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 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 board.
- B. Multilayer Application 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.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- E. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

F. Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.10 INSTALLING DENS GLASS

- A. Install per Manufacturers Recommendations.

3.11 INSTALLING STRUCTURAL PANEL FLOOR SYSTEM

- A. Install per Manufacturers Recommendations.

3.12 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Install corner bead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
 3. Install U-bead where indicated.
- D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.13 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of corner bead, 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 using setting-type joint compound.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- E. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 2. Level 2: Where panels are substrate for tile and where indicated.
 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
- F. Glass-Mat, Water-Resistant Tile Backing Panels: Finish board forming base for ceramic tile to comply with ASTM C 840 and according to manufacturer's written instructions for treatment of joints behind tile.
- G. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.
- H. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.
- I. 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.
1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with the paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
 2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
 3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
 4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

3.14 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.
 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
 - g. Installation of ceiling support framing.

3.15 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.

- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensures gypsum board assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 09260

SECTION 096500 – RESILIENT FLOORING AND ACCESSORIES

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 the following:
 - 1. Vinyl composition tile (VCT).
 - 2. Resilient wall base, reducer strips, and other accessories.
 - 3. Independent testing of concrete.
 - 4. Stair treads.
- B. Related Sections include the following:

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 013300.
- B. Product Data: For each type of product indicated.
- C. Samples: For each type of product indicated. Samples shall be in form of manufacturer's color charts consisting of the following:
 - 1. Resilient Accessories: Color charts consisting of strips of resilient base showing the full range of colors available for each product exposed to view.
- D. Moisture, Relative Humidity, and Alkalinity and Adhesion Tests: Provide results of specified moisture, relative humidity, and alkalinity and adhesion tests and manufacturer's written moisture and alkalinity requirements for each resilient flooring type specified.
- E. Product Certifications: Signed by resilient flooring manufacturer of products supplied that products comply with specifications and local regulations controlling use of volatile organic compounds (VOC's).
 - 1. Flooring manufacturers shall certify that proposed adhesives are acceptable for use with each type of floor covering.
- F. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Smoke Density: Less than 450 per ASTM E 662.
 - 2. Critical Radiant flux: 0.45 watts per sq. cm or more per ASTM C 648.
- B. Source Limitations for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces and rolls upright.
- C. Move flooring materials and accessories and installation products into spaces where they will be installed at least 48 hours in advance of installation. Do not install flooring materials until they are at same temperature as space where they are to be installed.

1.6 PROJECT CONDITIONS

- A. Maintain ambient and substrates temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.

1.7 SEQUENCING AND SCHEDULING

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive as determined by manufacturer's recommended bond and moisture test.
- C. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

1.8 EXTRA MATERIALS

- G. A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 100 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
 - 2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 750 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 VINYL COMPOSITION TILE

- A. Vinyl Composition Tile, VCT: ASTM F 1066.
 - 1. Product: Mannington Essentials / Designer Essentials
 - 2. Class: 2 (through-pattern tile).
 - 3. Wearing Surface: Smooth.
 - 4. Thickness: 0.125 inch.
 - 5. Size: 12 by 12 inches.
 - 6. Colors: As indicated in Materials Legend.
 - 7. Fire-Test-Response Characteristics:
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.3 RESILIENT WALL BASE

- A. Wall Base, WB: ASTM F 1861.
Manufacturers: Vinyl Wall Base; Johnsonite or architectural approved equal.
- B. Type (Material Requirement): TV (vinyl).
- C. Group (Manufacturing Method): I (solid).
- D. Style: Cove (with top-set toe) and straight (toeless) at carpet.
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches.
- G. Lengths: Coils in manufacturer's standard length.
- H. Outside Corners: Job formed.
- I. Inside Corners: Job formed.
- J. Surface: Smooth.
- K. Colors: As indicated in Materials Legend.

2.4 RESILIENT MOLDING ACCESSORY

- A. Manufacturer: Johnsonite or architectural approved equal.
- B. Material: Vinyl.
- C. Transition Strips: The following product identification numbers are for products manufactured by Johnsonite. Provide listed products or equal from one of listed manufacturers.
 - 1. Carpet to Resilient: No. CTA-XX-D.
 - 2. Resilient to Concrete: No. RRS-XX-C.
 - 3. Carpet to Concrete: No. EG-XX-G.
 - 4. Corner for carpet at stair edge.

2.5 RESILIENT STAIR ACCESSORIES Resilient Stair Treads:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - b. Endura Rubber Flooring; Division of Burke Industries, Inc.
 - c. Flexco, Inc.
 - d. Johnsonite.
 - e. Musson, R. C. Rubber Co.
 - f. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
 - g. Roppe Corporation, USA.
- B. Resilient Stair Treads Standard: ASTM F 2169.
 - 1. Material Requirement: Type TV (vinyl, thermoplastic).
 - 2. Surface Design:
 - a. Class 2, Pattern: Raised-disc design.
 - 3. Manufacturing Method: Group 1, tread with embedded abrasive strips.
- C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
- D. Nosing Height: 1-1/2 inches (38 mm).
- E. Thickness: 1/4 inch (6 mm) and tapered to back edge.
- F. Size: Lengths and depths to fit each stair tread in one piece.
- G. Thickness: 0.125 inch (3.2 mm).
- H. Colors and Patterns: As selected by Architect from full range of industry colors.

2.6 INSTALLATION MATERIALS

- A. Concrete Slab Primer: Nonstaining 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: Premium grade, water-resistant type acceptable to manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Provide spray adhesive for VCT.
 - 2. VCT adhesive shall have a VOC level of no more than 50 g/L.
 - 3. Rubber floor adhesive shall have a VOC level of no more than 60 g/L.
 - 4. Cove base adhesive shall have a VOC level of no more than 50 g/L.
 - 5. Subfloor adhesive shall have a VOC level of no more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- D. A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer, and with the specified requirements.
 - 2. An independent testing agency shall perform calcium chloride moisture tests, relative humidity test, alkalinity tests, and adhesion test. Testing shall be conducted as follows:
 - a. Maintain a minimum temperature of 70 deg F in spaces to receive flooring for at least 72 hours prior to and during the tests.
 - b. Perform the tests at rate of not less than 1 test/1000 sq. ft. of floor area for slabs-on-grade and 1 test/ 2000 sq. ft. of floor area for elevated slabs.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests in accordance with recommendation of flooring manufacturer and the following specified requirements:
 - a. Anhydrous Calcium Chloride Moisture Tests: Perform in accordance with ASTM F 1869, except tests shall not deduct area of CaCl₂ dish.
 - b. Relative Humidity Test: Conduct in accordance with ASTM F 2170.
 - 5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, relative humidity tests are acceptable, and meet manufacturer's requirements for relative humidity and alkalinity and adhesion.
- C. 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.
- D. Use trowelable leveling and patching compound to fill cracks, holes, saw cuts, and depressions in substrates.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 6. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT FLOOR COVERING INSTALLATION, GENERAL

- A. Install in accordance with floor covering manufacturer's written instructions and requirements of this Section.
- B. Scribe, cut, and fit floor covering to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- C. Extend floor covering into toe spaces, door reveals, closets, and similar openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor covering as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- E. Delete first paragraph below if no covers.
- G. Install floor covering on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of floor covering installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter. Install tiles square with room axis, unless otherwise indicated.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
Verify pattern and grain direction with Architect prior to installation.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Revise below if other than full-spread adhesive method is recommended by tile manufacturer for substrate and tile products selected.
- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

- G. Hand roll tiles where required by tile manufacturer.

3.5 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Provide on fronts and exposed sides and backs of floor-mounted casework. Where toe space is less than base height, cut down base to proper height.
 - B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- I. E. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
 - 3. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

3.6 RESILIENT ACCESSORY INSTALLATION

- J. A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.7 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation of resilient floor coverings and accessories:
 - 1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient floor coverings manufacturers.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
 - 4. Not more than 7 days after completion of installation, apply 1 coat of sealer/wax to a clean, dry floor covering per manufacturer's requirements, protecting surface with uniform coating and gloss. Work shall be done by a floor care subcontractor.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 5. 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturers.

- a. Coordinate selection of floor polish with Owner's maintenance service.
6.
 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Final cleaning, polishing and buffing specified in Division 1 Section "Closeout Procedures."

END OF SECTION 09650

SECTION 096800

CARPET

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes carpet.
- B. Related Sections include the following:
 - 1. Division 9 Section "Resilient Flooring" for resilient wall base and accessories installed with carpet.

1.03 SUBMITTALS

- A. General: Submit in accordance with Section 013300.
- B. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of installation for each type of substrate.
 - 5. Pattern type, repeat size, location, direction, and starting point.
 - 6. Type, color, and location of edge, transition, and other accessory strips.
 - 7. Transition details to other flooring materials.
- D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12-inch- square Sample.
 - 2. Carpet Seam: 6-inch Sample.
- E. Test Results: Provide results of specified moisture tests, alkalinity and adhesion tests, and manufacturer's written moisture requirements for each type of carpet specified.
- F. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

- G. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Source Limitations: Obtain each type of carpet through a single source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at project site to comply with requirements of Division 1 Section "Project Meetings." Review specified moisture test results, alkalinity and adhesion tests, ambient conditions, ventilation procedures, installation process, adhesive application, seam sealing procedures and seam layouts.
 - 1. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

1.05 LAYOUT

- A. Seam Layout: Layout differing from approved Shop Drawings shall be sufficient reason for rejection.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling."
- B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
- C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off floor.

1.07 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at and will continuously maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.08 WARRANTY

- A. General Warranty: Special warranty 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. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to failure of substrate, vandalism, or abuse. Warranty shall not require the use of chair pads. Failures include, but are not limited to, edge raveling, snags, zippering, backing resiliency loss, and delamination.
 - 1. Warranty Period: 10 years for surface wear including more than 10 percent loss of face fiber.

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 3 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.01 CARPET

- A. Walk off Mats for Elevator.
 - 1. Construction: Multi Level loop
 - 2. Yarn: 100% High-Abrasive Nylon
 - 3. Yarn Weight/Tufted: 160 ounces/yard squared.
 - 4. Flammability: (ASTM E648) Class I.
 - 5. Pattern and Color: Clean Step with color to be chosen by Architect.

2.02 INSTALLATION ACCESSORIES

- A. Product shall comply with South Coast Air Quality Management District (SCA!MD) Rule #1168 effective date of July 1, 2005 and rule amendment date of January 7, 2005:
Architectural Non Porous Sealant Primer: 250 g/L
Architectural Porous Sealant Primer: 775 g/L
All Other Sealant Primers: 750 g/L
- B. Concrete Slab Primer: Nonstaining type provided by or recommended by the carpet manufacturer.
- C. Trowelable Leveling and Patching Compounds: Portland-cement-based formulation provided by or recommended by the carpet manufacturer.
- D. Adhesives: Premium grade, water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the carpet manufacturer, permitting a moisture emission rate up to 5 lb/1000 sq. ft./24 hours.
 - 1. Product: Commercialon Premium Carpet Adhesive.

- E. Seaming Cement: Adhesive product recommended by carpet manufacturer for sealing seams and butting cut edges at backing to form secure watertight seams and to prevent pile loss at seams.
 - 1. Commercialon Premium Carpet Seam Sealer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer, and with the following specified requirements:
 - a. An independent testing agency shall perform alkalinity and adhesion tests, calcium chloride moisture tests, and relative humidity tests.
 - 1) Perform tests on slabs to receive glue down carpet installation at rate of 1 test/1000 sq. ft. of floor area for slabs-on-grade and 1 test per 2000 sq. ft. of floor area for elevated slabs.
 - 2) Maintain a minimum temperature of 70 deg F in spaces to be tested for at least 72 hours prior to and during the tests.
 - b. Alkalinity and Adhesion Testing: Shall result in pH range recommended by carpet and carpet tile manufacturers when subfloor is wetted with potable water and pHydriion paper is applied. Perform pH tests on concrete floors regardless of age or grade level.
 - c. Calcium Chloride Moisture Tests: Tests shall be conducted in accordance with ASTM F 1869-02, except that area of CaCl₂ dish shall not be deducted.
 - d. Relative Humidity Test: Conduct in accordance with ASTM F 2170.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
 - 4. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, relative humidity tests are acceptable, and meet manufacturers' requirements for alkalinity and adhesion.
- D. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Level subfloor within 1/4 inch in 10 feet, noncumulative, in all directions using product recommended by manufacturer. Sand or grind protrusions, bumps, and ridges.
 - 1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by carpet manufacturer.
- D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Concrete Subfloor Preparation: Apply concrete slab primer, according to manufacturer's directions, where recommended by the carpet manufacturer.

3.03 INSTALLATION

- A. Comply with carpet manufacturer's written installation instructions.
- B. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation" and carpet manufacturer's installation procedures and requirements.
- C. Comply with carpet manufacturer's written recommendations and approved Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- D. Where demountable partitions or other items are indicated for installation on top of finished carpet, install carpet before installation of these items.
- E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 2. Remove yarns that protrude from carpet surface.
 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer to ensure carpet is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09680

SECTION 099113 - 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

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Wood.
 - 5. Plastic trim fabrications.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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. ICI Paints.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. 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.

B. Colors: As selected by Architect from manufacturer's full range.

C. VOC Content: All painting products listed in this section should be used only on the exterior of the building. Any Painting products used on the interior of the building must conform with the South Coast Air Quality Management District (SCAQMD) Rule 113, Architectural Coatings – Standard VOC Limits.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

2.4 WOOD PRIMERS

A. Exterior Latex Wood Primer: MPI #6.

1. VOC Content: E Range of E1.

2.5 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of E1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating 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 and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that 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.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers 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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Aluminum Substrates: Remove surface oxidation.
- 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.
- I. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 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.
- 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.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

- 1. Latex System: MPI EXT 3.1A.
 - a. Prime Coat: Exterior latex matching topcoat.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (flat).

B. Steel Substrates:

- 1. Quick-Drying Enamel System: MPI EXT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel (**semigloss**).

C. Galvanized-Metal Substrates:

- 1. Latex System: MPI EXT 5.3A.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (semigloss).

D. Aluminum Substrates:

- 1. Latex System: MPI EXT 5.4H.
 - a. Prime Coat: Quick-drying primer for aluminum.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (semigloss).

E. Wood Panel Substrates: Including doors.

- 1. Latex System: MPI EXT 6.4K.
 - a. Prime Coat: Exterior latex wood primer.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (**semigloss**).

F. Wood Shingle and Shake Substrates (Excluding Roofs):

1. Latex System: MPI EXT 6.6E.
 - a. Prime Coat: Exterior latex wood primer.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (**semigloss**).

G. Plastic Trim Fabrication Substrates:

1. Latex System: MPI EXT 6.8A.
 - a. Prime Coat: Bonding primer (water based).
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (flat).

END OF SECTION 099113

SECTION 099123 - 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. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Aluminum (not anodized or otherwise coated).
 - 4. Wood.
 - 5. Gypsum board.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. 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.

B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer: MPI #50.
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- B. Interior Alkyd Primer/Sealer: MPI #45.
 - 1. VOC Content: E Range of E1.
- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.4 METAL PRIMERS

- A. Quick-Drying Alkyd Metal Primer: MPI #76.
 - 1. VOC Content: E Range of E2.
- B. Rust-Inhibitive Primer (Water Based): MPI #107.
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.

2.5 WOOD PRIMERS

- A. Interior Latex-Based Wood Primer: MPI #39.
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.

2.6 LATEX PAINTS

- A. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 1.5.
- B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.

- D. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.

2.7 ALKYD PAINTS

- A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
 - 1. VOC Content: E Range of E2.
- B. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
 - 1. VOC Content: E Range of E2.
- C. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- D. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - 1. VOC Content: E Range of E2.

2.8 FLOOR COATINGS

- A. Interior Concrete Floor Stain: MPI #58.
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- B. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - 1. VOC Content: E Range of E2.
- C. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - 1. VOC Content: E Range of E2.

- D. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 3.
- E. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - 1. VOC Content: E Range of E2.
 - 2. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating 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 plates, machined surfaces, and similar items already in place that 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.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers 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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Aluminum Substrates: Remove surface oxidation.
- 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.
- I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 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.
- 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 Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Electrical Work:
 - a. Panelboards.
 - b. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex Over Sealer System: MPI INT 3.1A.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (low sheen).

- B. Concrete Substrates, Traffic Surfaces:
 - 1. Clear Sealer System: MPI INT 3.2F.
 - a. First Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - b. Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
- C. Steel Substrates:
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (eggshell).
- D. Galvanized-Metal Substrates:
 - 1. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - a. Prime Coat: Waterborne galvanized-metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (eggshell).
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - 1. Latex System: MPI INT 5.4H.
 - a. Prime Coat: Quick-drying primer for aluminum.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (eggshell).
- F. Wood Panel Substrates: Including painted plywood and medium-density fiberboard.
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.
 - a. Prime Coat: Interior latex-based wood primer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).
- G. Gypsum Board Substrates:
 - 1. Latex System: MPI INT 9.2A.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (eggshell).

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes the following types of signs:

1. Exterior dimensional letters.
2. Signage.

B. Room, Bathroom, Stair, and Interior ADA signage by owner.

1.2 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and erection of exterior metal signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
3. Provide message list for each directory required, including large-scale details of wording and lettering layout.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:
 - a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
2. Wiring diagrams from the manufacturer for illuminated signs:
 - a. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.
 - b. Dimensional letters.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Criteria: Design, fabricate, and install signs to withstand a wind pressure of 100 mph on the total sign area in all directions.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- B. Design Criteria: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design Criteria: Design, fabricate, and install signs to withstand a wind pressure of 100 mph on the total sign area in all directions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work. Use metals that are compatible with one another.
- B. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for the application intended.

2.2 DIMENSIONAL LETTERS

- A. Interior Dimensional Letters:
 - 1. Exterior size: 5" x 3/8.
 - 2. Exterior material: copper on exterior.
 - 3. Font: Upper Century School Book Bold.

2.3 SIGNAGE

- A. All signage to meet ADA and UNE sign standards.
- B. Locations: At all interior doors off of the hallways that are not labeled future and the following:
 - 1. All stairway doors on both sides.
 - 2. All stairway landings.
 - 3. Signs stating the following for Stair B:
 - a. "Egress only beyond this floor" at second floor level.

- b. "No building access beyond this point" at ground level landing.
- c. "No access to first floor in this stairwell" at first floor landing.

C. Manufacturer: Perfect Signs, 282-1000 or architect approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Set anchor bolts and other items required for installation post and panel signs. Use templates, setting drawings diagrams, instructions, and directions provided by suppliers of items to be attached.
- C. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Install with fully surfaced rear faced double-stick foam adhesive tape.

3.2 CLEANING AND PROTECTION

- A. At completion of the installation, clean soiled surfaces of sign units in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10425

SECTION 104416 - 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, fire extinguishers and mounting brackets for fire extinguishers.
- B. Owner-Furnished Material: Wheeled fire extinguishers.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. 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.
- C. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals." Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- 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 FMG.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

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 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - h. Larsen's Manufacturing Company.
 - i. Moon-American.
 - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - k. Potter Roemer LLC.
 - l. Pyro-Chem; Tyco Safety Products.
 - 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 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. 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: Vertical.

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.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 14240

HYDRAULIC ELEVATOR

1. GENERAL:

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. 110 volt branch circuit to the terminals of the elevator controller for car light supply and 110 volt light and outlet in the elevator pit, complete with switch adjacent to the pit ladder as shown on Elevator Drawings.
- B. Any cutting, patching or painting of walls and grouting under thresh-holds and hoistway frames.
- C. Adequate supports for guide rail brackets.
- D. Sill support angles.
- E. Electrical current during erection and testing of equipment. 3 phase fused disconnect, & 110 volt fused disconnect
- F. Necessary recesses to accommodate doors, sills, (min. 2-1/2" deep) and signal equipment such as indicators, push buttons, hall lanterns, etc.
- G. Pit access ladder.
- H. General Contractor to receive, handle and store in the building approximately ten (10) tons of elevator materials.
- I. Smoke sensors in each elevator lobby and elevator machine room complete with necessary wiring to elevator controller. A shunt trip circuit breaker with heat detectors will also be provided as required.

1.3 REGULATORY AGENCIES: Perform all work in accordance with the National Electrical Code, American Standard Safety Code and such state and local codes as may be applicable.

1.4 SUBMITTALS: Shop Drawings-

- A. Submit six (6) blue print copies of elevator layout drawings to the Architect for approval.
- B. Upon completion submit to Owner, warrantee operating manual and maintenance information.

1.5 GUARANTEE:

- A. Elevator Contractor shall guarantee that materials and workmanship of apparatus installed by him under these Specifications shall be first class in every respect; and that he will make good

any defects not due to ordinary wear and tear or improper use which may develop within one (1) year from date of completion and installation.

- B. In addition to the other requirements, inspection, tests and remedies herein provided upon completion of elevator installation and before final approval and final payment, Elevator Contractor shall make, in speed test with full maximum load on elevator to determine whether elevator equipment as installed meets the speed, capacity and all other requirements of the Specifications.
- C. In event equipment does not meet all requirements of Specifications, Elevator Contractor shall promptly remove from the premises all work condemned by Architect as failing to conform to the contract and shall bear all expense of making good all work of other Contractors destroyed or damaged by such removal or replacement. If Elevator Contractor does not remedy such condemned work within a reasonable time, fixed by written notice from Architect, General Contractor may correct such condemned work at expense of Elevator Contractor and withhold such cost from final payment under contract price. In the event the remainder due under Contract price is insufficient to cover such a cost, Elevator Contractor shall, immediately upon request, reimburse General Contractor in full.

1.6 PERMITS, TAXES AND LICENSES: All permits, inspection fees and licenses necessary for the execution of the work shall be secured and paid for by the Elevator Contractor.

1.7 TEMPORARY USE: The General Contractor, Sub-contractors, Owner or others will not be permitted use of the elevators during construction except under a written agreement as stipulated by the Elevator Contractor.

2. PRODUCTS:

2.1 ACCEPTABLE MANUFACTURES:

- A. Except as otherwise specified herein, or specifically approved by Architect, the Elevator Contractor shall be regularly engaged in installation of elevators of type specified herein, and shall be able to demonstrate at least three (3) installations of this type made by him within the State of Maine which have provided satisfactory operation for a period of one (1) year prior to the date of receipt of General Bids, for this project.
- B. Demonstrate that he has provided satisfactory maintenance service for elevators of type specified and that he has maintained a complete maintenance organization comprised of regularly employed inspectors and mechanics within the State of ME for a period of at least one (1) year prior to the date of receipt of General Bids.
- C. Provide 1 year maintenance warrantee for insuring problem free operation of elevator, and make available complete ongoing maintenance service package.
- D. Elevator shall be equal to Canton Elevator Company, or approved equal. Elevator shall meet latest ANSI handicapped requirements and New Hampshire State Elevator Code.
- E. Delivery of elevator systems shall be guaranteed by Manufacturer to be on site sixteen (16) weeks after receipt of approved Shop Drawings. Shop Drawings shall be submitted to the General Contractor for review by the Architect within ten (10) days of Sub-Contractors award.

2.2 MATERIALS AND FABRICATIONS:

A. Description of equipment –

Quantity – Capacity:	1 elevator front and rear #1-3500 lbs.;
Speed:	90 fpm
Operation:	Simplex selective collective –confirm with owner
Travel:	Approximately (31'-3") as shown on Drawings
Power supply:	208 v 3 phase, 60 cycle.
Machine Location:	As shown on Drawings (remote)
Stops & Openings:	5 stops – 4 front and 1 rear as drawn
Car Enclosure:	High pressure laminate interior panels, overhead fluorescent lighting above egg crate suspended ceiling, stainless steel returns, and stainless steel car doors. Handrail on side walls. Carpeted floor by others.
	One (1) set Protection pads and hooks per car
	Include: ADA compliant telephone Fan Emergency Lighting Proximity detectors, door protection
Hoistway Door Frames:	Hollow metal U.L. "B: labeled door, square frame
Door Size & Type:	3'-6" W x 7'-0"H; - (clear opening) finish to be baked enamel; color to be selected from standard selection charts
Door Operation:	D.C. Power Operation
Signals:	Illuminated halo buttons, (Braille) alarm bell, in car location. Hall position indicator at main floor level. In – Car Direction Lantern
Special Features:	Special handicap provisions Door Hold Key Service Independent Operation Key Switch Card reader provision

Motor HP:	3 Phase Power 30 HP Max
Starter	Solid state soft start

B. Jack unit:

1. The jack unit shall be designed and constructed in accordance with the applicable requirements of the American Standard Safety Code for Elevators A-17. It shall be of sufficient size to lift the gross load the height specified. It shall be factory tested to insure adequate strength and freedom for leakage. No brittle material, such as gray cast iron, shall be used in the jack construction.
2. The jack unit shall consist of the following parts: a plunger of heavy polished steel tubing accurately turned; a stop ring shall be electrically welded to the plunger to positively prevent plunger leaking its casing made of steel tubing and provided with a pipe connection and air bleeder; Brackets shall be welded to jack casing and supporting the elevator on pit channels.
3. A PVC cylinder protection system shall be installed. Union Guard corrosion protection to fill void no exceptions.
4. A standard wellhole with steel pipe casing to retain the hole shall be provided. All drilling spoils are to be removed by the general contractor. Water for drilling, if required, will be provided by others also. Should obstructions such as boulders, debris, water, quicksand or any other condition other than normal soil, clay or standard ledge be encountered, additional time to drill the hole will be treated as a change order. Work to cease until a change order is issued. Note: drilling will be inside existing building.

C. Car:

1. Platform and Sling: The platform and sling have a fabricated frame of formed and structural steel shapes, gusseted and rigidly welded. Flooring shall be wood top floor laid over wood sub-floor. Finished flooring shall be provided, by others, on top of the car platform.
2. The sling shall consist of heavy steel channel stiles properly affixed to a steel cross head and bolster, with adequate bracing members, to remove all strain from the car enclosure.
3. Steel bumper plates shall be affixed to bottom of bolster channels; and a platen plate with clamps and car screws shall be furnished for fastening sling to plunger.

D. Car doors: The car entrance shall be provided with horizontal sliding doors. Panel rigidity to be obtained by suitable steel reinforcements. Doors shall be hung on sheave hangers with polyurethane tires and sheaves not less than 2-1/2" diameter running on a polished steel track, and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.

E. Alarm bell: An emergency alarm bell shall be located in conformance with ANSI A-17 Code requirements, and connected to a plainly marked push button in the car. Alarm bell shall be connected to the emergency lighting power pack.

- F. Guide and Guide Shoes: Guides for the elevator car shall be planed steel elevator guide rails, properly fastened to the building structure with steel brackets. The car stile shall be fitted at top and bottom with sliding guide shoes.
- G. Power Unit:
1. (Oil pumping and control mechanism) shall be compactly and neatly designed with all of the components listed below combined in a self-contained unit; structural steel outer base with tank supports; floating inner base for mounting motor pump assembly; over head oil reservoir with tank cover and controller compartment with cover; metal drip pan; oil-hydraulic pump; electric motor; and oil control unit with the following components built into a single housing: a high pressure relief valve, a check valve, an automatic unloading up start valve, a lowering and leveling valve, and a magnetic controller, or a self contained submersible of manufactures standard type.
 2. The pump shall be especially designed and manufactured for oil-hydraulic elevator service. It shall be of positive displacement screw type, inherently designed for steady discharge with minimum pulsations to give smooth and quiet operation. Output of pump shall not vary more than ten percent (10%) between no load and full load on elevator car.
 3. Motor shall be especially designed for oil-hydraulic elevator service, of standard manufacturer and of duty rating to comply with herein specified speeds and loads.
 4. Oil control unit shall consist of the following components, all built into a single housing. Welded manifolds with separate valves to accomplish each function will not be acceptable under this Specification. All adjustments shall be accessible and shall be made without removing the assembly from the oil lines:
 - a. Relief valve shall be externally adjustable and shall be capable of bypassing the total oil flow without increasing back pressure more than ten percent (10%) above that required to barely open the valve.
 - b. Up start and stop valve shall be externally adjustable, and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, insuring smooth up starts and up stops.
 - c. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 - d. Lowering valve and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to insure smooth "Down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling when slow down is initiated.
 5. Electric controller shall be of the full magnetic type or solid-state integrated circuitry. Silver to silver contacts shall be utilized on all relays and contractors. Thermal overload relays to be provided to protect the motor. All component switches to be mounted in a steel panel designed for wall to floor mounting. Shall have built in diagnostics, no proprietary tools required to service unit.

- H. Mainline Strainer: A mainline strainer of the self-cleaning type, equipped with a 40-mesh element shall be furnished and installed in the oil line.
- I. Failure Protection: The electrical control circuit shall be designed so that if a malfunction should occur, due to motor starter failure, oil becoming low in the system, or the car failing to reach a landing in the up direction within a predetermined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches the landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.
- J. Sound Isolating Coupling: Install a minimum of two in the oil line in the machine room between pump and jack.
- K. Oil-Hydraulic Silencer (muffler device): Install in oil line near power unit. It shall contain pulsation-absorbing material inserted in a blowout-proof housing arranged for inspecting interior parts without removing unit from oil line. Rubber hose without blowout-proof features will not be acceptable.
- L. Vibration Pads: Mount under the power unit assembly to isolate the unit from the building structure.
- M. Automatic Terminal Limits: Place electric limit switches in the hatchway near the terminal landing; designed to cut off the electric current and stop the car should it run beyond either terminal landing.
- N. Automatic Self-leveling: Provide elevator with a self-leveling feature that will automatically bring the car to the floor landings. This self-leveling shall, within its zone, be entirely automatic and independent of the operating device, and shall correct for over travel or under travel. The car shall also be maintained approximately level with the landing regardless of the load.
- O. Buffers: Furnish and install substantial buffers under the car in the elevator pit. They shall be mounted on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor and substantial extensions will be provided, if required. Buffers shall comply with ANSI A-17.1 Code requirements.
- P. Car Top Inspection Station: A car top inspection station with an "emergency stop" switch and with constant pressure "up-down" direction buttons shall make the normal operating devices inoperative and give the inspector complete control of the elevator.
- Q. Door Operation: Furnish and install a direct current motor driven heavy-duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and door-operating mechanism shall be arranged for manual operation in event of power failure. The leading edge of the car door shall be provided with a retractable reversal edge arranged to automatically return car and hoistway doors to the open position in the event the doors are obstructed during closing cycle. Doors will then resume closing cycle.

Doors shall automatically open as the car arrives at the landing and shall automatically close after an adjustable time interval or when the car is dispatched to another landing. Direct drive geared operators, A.C. controlled units with oil checks, or other deviations for the above are not acceptable.

- R. Interlock: Equip each hoistway entrance with an approved type interlock tested as required by Code. The interlock shall be designed to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by Code and shall prevent opening the doors at any landing from the corridor side unless the car is at rest at the landing or is in the leveling zone and stopping at the landing. Interlocks shall bear Underwriter's Laboratories "B" label of approval.
- S. Hoistway Door Unlocking Device: Provide hoistway door unlocking devices as specified by the ANSI A-17.1 Code to permit authorized persons to gain access to hoistway when elevator car is away from the landing.
- T. Door Hangers and Tracks: For each hoistway sliding door, furnish and install sheave type two point suspension hangers and tracks complete. Sheaves shall be 2-1/2" in diameter and have polyurethane tires with ball bearings properly sealed to retain grease. Hangers shall be provided with an adjustable slide to take the up-thrust of the doors. Tracks are to be drawn steel shapes, smooth surface and shaped to conform to the hanger sleeves.
- U. Hoistway Entrances: Hoistway entrances of the hollow metal, horizontal sliding type shall be furnished and installed complete at each of the hoistway openings. Note that entrances must be at least minimum legal width for wheelchair use, meeting ANSI A-17.1.
1. Entrances shall be manufacturer's standard design and shall bear Underwriter's Laboratories "B" labels. They shall consist of frames, sills, doors, hangers, hanger supports, hanger covers, fascia plates, and all necessary hardware. Finish to be baked on enamel chosen from manufacturer's standard.
 2. The entire front wall of the hoistway is to be left open or a rough opening provided which is 12" greater in width and 6" greater in height than the finished opening, until after entrances are installed. After guide rails are set and lined, the entrance frames shall be installed in perfect alignment with the guide rails. Finish walls will then be completed by others.
- V. ADA telephone shall be furnished with wiring from elevator cab to the machine room and telephone box. Wiring to be coordinated with Electrical Contractor and tied into outside phone system.
- W. Operation (Selective Collective Automatic Push-button): Control of the elevator car shall be automatic in operation by means of a push-button in the car marked for each of the landing levels served and an "up-down" button at each intermediate landing with a call button at each terminal landing, wherein all stops registered by the momentary pressure of landing or car buttons shall be maintained until the car answers the call. An emergency stop switch shall be provided in the car push-button station which, when in the off position, will render the elevator inoperative, and which will enable attendant or passenger to stop the car at any point during its travel. Opening of this switch shall not cancel registered calls, and when the switch is closed the car will continue to answer calls that have been registered. Each landing station shall

contain an illuminated push-button which shall "light-up" when pressed to indicate that a call has been registered to bring the car to that particular landing. A time delay non-interference feature shall be incorporated in the control mechanism to allow simple time for opening and closing car and hoistway doors before it is again placed in motion.

X. Special Emergency Service:

1. Special Emergency Service Operation shall be provided in compliance with the latest revision of the ASME/ANSI A17.1 or CAN3-B44 Code.
2. Special Emergency Service Phase I to return the elevator non-stop to a designated floor shall be initiated by an elevator smoke detector system or a keyswitch provided in a lobby fixture.
3. The smoke detector system is to be furnished by others. The elevator contractor shall provide contacts on the elevator controller to receive signals from the smoke detector system.
4. A keyswitch in the car shall be provided for in-car control of each elevator when on Phase II of Special Emergency Service. Fire service to comply with the latest requirement by the State of Maine.
5. If an elevator is on independent service when the elevator is recalled on Phase I operation, a buzzer shall sound in the car and a message indicator will be activated.

END OF SECTION

**SECTION 16000
ELECTRICAL**

PART 1.00 – GENERAL

1.01 GENERAL PROVISIONS

- A. Applicable provisions of “General Conditions” govern work under this section.
- B. The Electrical Contractor shall review all other sections of these Specifications for requirements therein affecting the work of this Section.
- C. The Electrical Contractor shall conform to all sections of these Specifications and Drawings.
- D. Contractors duties for work specified below shall include compliance with all Codes, Ordinances, Rules, Regulations, Orders and all other requirements of Authorities which bear on performance of work.

1.02 SCOPE OF WORK

- A. Furnish all labor, supervision, permits, certificates, materials, equipment, apparatus, accessories, supplies, tools, transportation and services necessary for and incidental to, all electrical work as shown on the Drawings and/or specified hereinafter to the full completion of installation and operation of the electrical system.
- B. The principal items of work are as follows;
 - 1. Temporary Service
 - 2. Secondary Power Service
 - 3. Grounding
 - 4. Power and lighting panels
 - 5. Lighting fixtures and lamps
 - 6. Safety switches
 - 7. Feeders to panels
 - 8. Branch circuit wiring
 - 9. Outlet boxes, receptacles, etc.
 - 10. Fire Alarm System
 - 11. Emergency Lighting System
 - 12. All wiring for heating ventilating equipment, wherever required as indicated on Drawings, except control wiring and motor starters
 - 13. Site Lighting
 - 14. All other systems, equipment and work hereinafter specified and/or shown on the Contract Drawings.
- C. It is the intent of the Specifications and the accompanying Drawings that the systems shall be furnished and installed complete. The Electrical Contractor shall furnish and install all conduit, wire, boxes, equipment, devices and controls needed and usually furnished in connection with such work, whether specifically mentioned or not.
- D. This Contractor shall refer to the Architectural, Structural, Plumbing, Mechanical and Fire Protection Drawings and all other Drawings associated with the project, prior to the installation or roughing of the electrical outlets, conduit and equipment to determine the exact location of all outlets.

1.03 WORK NOT INCLUDED

- A. The following items of labor and material incidental and/or related to the installation of the electrical work will be provided and/or installed under other sections of the Specification.
 - 1. All cutting, patching and furring.
 - 2. Painting of all equipment and material other than factory finished.

3. Flashing
4. Excavation and backfill.
5. Concrete work.

1.04 DEFINITIONS

- A. The “Electrical Contractor” specifically means, the Contractor working under this section for the specifications.
- B. “Furnish and install” or “provide” means to supply, erect, install and connect up complete, in readiness for regular operation, the particular work referred to unless otherwise specified.
- C. “Piping” includes, in addition to pipe, all fittings, boxes, hangers and other accessories relating to such piping.
- D. “Concealed” means hidden from sight, in chases, furred spaces, shafts, hung ceilings and embedded in construction.
- E. “Exposed” means visible in sight, not installed “concealed” as defined above.
- F. “Approved Equal” means any equipment or material which is equal in quality, durability, appearance, strength, design and performance to the equipment or material specified and which will function adequately in accordance with the general design and is approved by the engineer.

1.05 CODES AND STANDARDS

- A. Unless otherwise specified or indicated, materials and workmanship shall conform to the latest edition of the following Standards, Codes, specifications, Requirements and Regulations.
 1. National Electrical Code
 2. State Electrical code
 3. National Electrical Contractor’s Association.
 4. National Electrical Manufacturer’s Association
 5. Underwriters’ Laboratories, Inc.
 6. National Fire Protection Association
 7. Local Wiring Inspector
 8. Local Fire Marshall
 9. State Fire Marshall
 10. All other State and Local Codes and/or Authorities having jurisdiction, including any and all other paragraphs of this Specification.

1.06 PERMITS AND FEES

- A. The Electrical Contractor shall secure and pay for all required permits.
- B. The Electrical Contractor shall carry in his bid price and pay all costs incurred for, standard to be performed in conjunction with this Contract that are necessary for and incidental to, the accomplishment of his work and the use of work when completed.
- C. The Electrical Contractor shall, after completion, furnish to the General Contractor a Certificate of Final Inspection and Approval from the Local Electrical Inspection Department.

1.07 MATERIALS AND WORKMANSHIP

- A. Materials and workmanship shall be the best of their respective kinds and in full accordance with the most modern construction methods.
- B. Electrical materials and equipment of types for which there are Underwriters’ Laboratories standard requirements, listings or labels, shall conform to their requirements and be so labeled.

1.08 TESTS

- A. The right is reserved to conduct acceptance tests of all equipment, wiring or any other work furnished under these Drawings and/or Specifications to determine the fulfillment of specific requirements and/or design.
- B. The Electrical Contractor shall conduct all such tests in the presence of authorized representatives of the Owner and at such times that the Owner may designate.
- C. The Electrical Contractor shall perform all tests, supply all instrumentation, personnel and make all adjustments of equipment and wiring as may be necessary.

1.09 PORTABLE OR DETACHABLE PARTS

- A. The Electrical Contractor shall retain in his possession and shall be responsible for, all portable and/or detachable parts and portions of the installation, including fuses, keys, locks, adapters, blocking clips, inserts, lamp instruction, drawings and all other devices or materials that are relative to and necessary for the proper operation and maintenance of the electrical system until final completion of his work.

1.10 PROTECTION AND CLEANING OF EQUIPMENT

- A. All electrical equipment, upon receipt, shall be adequately stored and protected from damage.
- B. After inspection, all electrical equipment shall be protected to prevent damage during the construction period. Openings in all conduits, raceways, fittings and boxes shall be closed to prevent entrance of foreign materials.
- C. Before completion of work and before final inspection, all damaged and/or defective equipment and material shall be replaced and all exposed surfaces of electrical equipment shall be clean.

1.11 DRAWINGS AND SPECIFICATIONS

- A. The Drawings and these Specifications are complimentary to each other and any labor or material called for by either, whether or not by both, necessary for the successful operation of any of the particular types of equipment furnished under this Contract, shall be furnished and installed.
- B. Before installing any of the electrical work, see that it does not interfere with the clearances required for existing finished columns, pilasters, partitions, or walls. Installed work, which interferes with other trades, shall be changed as directed by the Owner's representatives.

1.12 OBTAINING INFORMATION

- A. Obtain detailed information from the manufacturers of apparatus, which he is to furnish and install as to the proper method of installing and connecting same. Obtain all required information from the Owner's representative and other Subcontractors necessary to facilitate and complete the electrical work. Check all other Contract Drawings and all other sections of Contract Specifications for electrical equipment requiring connections and electrical characteristics of equipment should they differ from the Electrical Drawings.

1.13 SAFETY PRECAUTIONS

- A. The Electrical Contractor shall furnish, place and maintain power guards and other necessary construction, required for the prevention of accidents to secure safety of life and/or property.

1.14 REMOVAL OF RUBBISH

- A. After completion of the work, the Electrical Contractor shall remove all waste, rubbish and other materials left as a result of his operations and leave the premises in clean condition.
- B. The Electrical Contractor shall repaint any painted metal surfaces, which have been scratched, dented, or marred.

1.15 COORDINATION OF TRADES

- A. The Electrical Contractor shall give full cooperation to other trades and shall furnish (in writing, with copies to Engineers) any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. Where the work of the Electrical Contractor will be installed in close proximity to work of other trades or where there is evidence that this Contractor will interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. All cutting and patching, excavation and backfill shall be done by the General Contractor. The Contractor shall inform the General Contractor well in advance as to his requirements.

1.16 VISITING THE SITE

- A. The Electrical Contractor shall be required to visit the site and examine the existing conditions, which may affect his work under this Contract.

1.17 FIELD MEASUREMENTS

- A. The Electrical Contractor shall verify in the field all measurements necessary for his work and shall assume responsibility for their accuracy.

1.18 GUARANTEE

- A. The Electrical Contractor guarantees by his acceptance of the Contract that all work installed will be free from any and all defects in workmanship and/or materials during period of one (1) year from date of Certificates of Completion and acceptance of work. If any such defects in workmanship or material appear, he will, without cost to the Owner, remedy such defects within a reasonable time.

1.19 SHOP DRAWINGS AND SAMPLES

- A. Before ordering material shipped to the job, the Electrical Contractor shall submit to the General Contractor for approval manufacturers references and bulletins, Shop Drawings, in sextuplet, giving all details, dimensions, etc. of the following;
 - 1. Light and Power panels
 - 2. Main Service equipment
 - 3. All lighting fixtures and lamps
 - 4. Time Controllers
 - 5. Disconnect switches
 - 6. Fire Alarm equipment
 - 7. Emergency Lighting System components
 - 8. Wiring Devices (each type)
 - 9. Wiring (each type)
- B. Should the Electrical Contractor choose to substitute for the specified equipment, the Shop drawing submittals must include catalog cuts of originally specified

equipment. Shop Drawings submitted for approval without all of the required information will not be considered for approval.

1.20 SUPERINTENDENCE OF WORK

- A. The Electrical Contractor shall give his personal superintendence to the work and shall retain at the job site during the period of construction, a competent Foreman, satisfactory to the Contractor, who shall be in full charge of the work under this section.

1.21 STORAGE OF MATERIALS

- A. The Electrical Contractor shall store his material and equipment before installation only where designated by the General Contractor. He shall be responsible for all his property stored on the premises and shall hold the General Contractor free from liability for loss by theft or carelessness of employees of the General contractor or of other Sub-Contractors. The Electrical Contractor shall take particular care to protect any finished work for injury or defacement and must remedy, at his expense, any injury caused thereto by his operations.

1.22 RECORD DRAWINGS

- A. The Electrical Contractor shall maintain at the site a set of black line prints on which shall be accurately shown the actual installation of work under this section, indicating therein and variation, approved by the General contractor, from the Contract Drawings, including changes in sizes, locations and dimensions at the conclusion of the work, the Electrical Contractor shall deliver to the General Contractor for submittal to the Owner a set of black line prints showing the entire work as actually installed.

1.23 CONTRACT DRAWINGS

- A. The Contract Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangements of equipment, conduits, piping and fixtures.
- B. If directed by the General Contractor, the Electrical Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

1.24 TEMPORARY SERVICE

- A. Furnish and erect a suitable backboard for temporary panel. Furnish and mount on this temporary board, an approved type of service switch and do all necessary wiring to connect such circuits as required.
- B. Special heavy-duty circuits shall be paid for by the trade requiring same.
- C. Obtain city-wiring permit for the temporary wiring and pay all fees for same.

PART 2.00 – PRODUCTS

2.01 ELECTRICAL METALLIC TUBING

- A. Electrical metallic tubing shall be Electro-galvanized outside and enameled inside. All electrical metallic tubing shall bear an Underwriters' Laboratories label and shall conform to Federal Specifications WW-C-563 and American Standards Association Specification C80-3.
- B. Couplings and fittings for EMT shall be of the compression type or set screw type. EMT shall not be installed embedded in concrete, outdoors or in wet locations.

- C. Any exposed wiring within the facility shall be installed in Electrical Metallic Tubing.
- D. Conduit sleeves shall be installed at all floors for voice/data network connectivity. Sleeves shall be fire rated to maintain the integrity of the floor assembly.

2.02 FLEXIBLE METALLIC CONDUIT

- A. Flexible metal conduit shall be galvanized steel, and shall contain an integral copper grounding conductor. Liquid-tight flexible metal conduit shall be similar, but shall also have an extruded moisture and oil-proof outer jacket of polyvinyl chloride plastic.
- B. Flexible metal conduit shall be utilized on all vibrating electrical equipment and shall be no greater than three feet in length.
- C. Liquid-tight flexible conduit shall be utilized on final connections to any outdoor equipment.

2.03 PVC CONDUIT

- A. Plastic conduit shall be PVC Schedule 40, iron pipe size, rigid polyvinylchloride equal to or better than ASTM Pipe Material ASTM PVC conduit Type 2, Grade 1, ASTM PVC 2110, Specification P-1785, Underwriters' Laboratory, Inc. approved for lengths beyond ten (10) feet shall be identical to the approved conduit. Where elbows are used, they shall be long radius type. PVC Conduit shall be manufactured by Kraloy, Barrett Division of Allied Chemical, Pittsburgh; Triangle Cable and Conduit Co., or approved equal.
- B. Couplings and fittings for EMT shall be of the compression type or steel set screw type. EMT shall not be installed embedded in concrete, outdoors or in wet locations.
- C. Any exposed wiring within the facility shall be installed in Electrical Metallic Tubing and shall be secured every 10'-0" on center.

2.04 WIREWAYS

- A. Totally enclosed sheet steel wireways, complete with all fittings, tees, elbows, wire retainers, closure plates, hangers, and component parts required for a complete installation shall be installed in all areas indicated on the Drawings and as required to facilitate the installation of the electrical systems.
- B. Physical size, length, and internal cross sectional areas, of the wireways shall be determined in the field by the Electrical Subcontractor to suit field conditions unless noted otherwise on the Drawings.
- C. The wireway systems shall be constructed of code gauge galvanized sheet steel with hinged cover. Straight sections of the wireway system shall be constructed of two separate pieces of sheet steel. One piece shall be used to form the sides and top, the other to form the cover. Captive screws, furnished as a part of the wireway system, shall be used for sealing at all hinged covers and coupling at straight sections or fittings.
- D. All fittings, elbows, tees, and straight sections of the wireway shall be provided with smooth and round edges to protect the wiring from abrasion. All welded seams and joints shall be ground and polished to remove burred edges.
- E. A bonding jumper consisting of an insulated flexible #8 AWG copper conductor with soldered eyelet on each end shall be provided to bound and ground the wireway at each joining section of the wireway system. The bonding jumpers shall be attached to each section by means of a bolt, locknut, and washer. The Electrical Subcontractor shall remove the paint from the wireway at the contact points so that positive contact shall be made between the bare metals at each grounding point.
- F. All sheet metal posts shall be factory primed with rust inhibiting phosphor coating and finished with USASI #24 dark gray enamel. All hardware shall be cadmium-plated to prevent rusting and corrosion.

- G. All lengths, connectors, and fittings of the wireway systems shall be UL approved and bear the Underwriters' Laboratories label. UL listing of lengths without listing of connectors and associated components or fittings shall not be acceptable.
- H. The wireway system, all component parts and fittings, shall be by one manufacturer and shall be manufactured by Kelek, Lee Products, Keystone or equal.

2.05 OUTLET, PULL AND JUNCTION BOXES

- A. The locations of all wall switch boxes shall be coordinated with the Drawings and Project Manager before installation of same. All switch boxes unless specifically noted otherwise on the Drawings shall be opposite the hinged side of the door for all single doors.
- B. The location of outlets shown on Drawings are approximate. The Electrical Contractor shall study the building plans in relation to the spaces and equipment surrounding each outlet, so that receptacles, switches, lighting fixtures, devices, or other electrical components are symmetrically located and mounted in or on the walls, ceiling, and floor.
- C. Outlet, junction or pull boxes, shown on the Drawings, that interfere with the installation of mechanical equipment, structural or architectural features, or that will be inaccessible due to the work of other trades shall be relocated accordingly.
- D. Outlet, junction or pull boxes that are not specifically shown on the Drawings but are required for the proper installation of the electrical system shall be installed by the Electrical Contractor, so that they do not interfere with the structural or architectural features and the installation of materials by the other trades.
- E. Any reasonable change in the location of outlets, pull or junction boxes requested by the Architect, prior to roughing, shall not involve additional expense to the Owner.
- F. All outlet, pull and junction boxes shall be installed in a rigid and satisfactory manner and shall be supported by bar hangers in frame constructions or shall be fastened directly with wood screws on wood, bolts with expansion shields on concrete or brick, toggle bolts on hollow masonry units and machine screws or welded threaded studs on metal. Threaded studs of the proper type and holding capacity driven in by a powder charge and provided with lock washers and nuts are acceptable for mounting of boxes on solid concrete walls or slabs. Preset inserts of the proper type and holding capacity shall be used in overhead slab construction wherever possible for the support of pull and junction boxes.
- G. Feeders passing through pull or junction boxes shall be individually grouped and bound with tie-raps. The feeders in each pull or junction box shall be properly tagged to clearly indicate their electrical characteristics, circuit number and panel designation. Cables shall be supported on suitable racks within the boxes and arranged in an orderly manner.
- H. Flush mounted ceiling and wall outlet boxes shall be provided with the proper type extension rings, tile and plaster collars required to set flush with the finished surfaces of the ceiling or walls.
- I. Outlet boxes shall, in general, be as follows:
 - 1. Exposed, surface and pendant mounted outlet boxes or outlet boxes installed in normally wet locations shall be of the cast metal type with threaded hubs as manufactured by Crouse-Hinds, Appleton, Red Dot, or Russell and Stoll.
 - 2. Recessed outlet boxes for non-hazardous locations shall be of the pressed sheet steel, zinc coated, cadmium plated type.
 - 3. Outlet boxes shall not be less than 1-1/2 inches deep unless shallower boxes are required by structural conditions and are specifically approved by the Architect.
 - 4. Ceiling and bracket outlet boxes shall not be less than 4 inch octagonal, except that smaller boxes may be used where required by the particular fixture to be installed. Flush or recessed fixture shall be provided with separate outlet boxes where required by the future terminal temperature requirements.

5. Outlet boxes for general use, flush mounted in concrete work and walls in non-hazardous and normally dry locations, shall be manufactured by Steel City, Appleton, Raco or equal.
- J. Pull and junction boxes shall, in general, be as follows:
 1. Pull and junction boxes shall be constructed of code gauge galvanized sheet metal, of not less than minimum size required by the N.E.C. or other applicable Specification "STANDARDS" and shall be furnished with securely fastened covers. Boxes exceeding 48 inches in any direction shall be properly reinforced with angle iron stiffeners.
 2. Pull and junction boxes of other than standard manufacturer's trade size shall be manufactured by Keystone, Lee Products or Empire.
 3. Standard trade size pull and junction boxes shall be produced by the manufacturers listed above as applicable.
 4. Pull and junction boxes to be installed in normally wet location areas shall be of the cast type with threaded hub and gasketed coverplate. The cast pull and junction boxes shall be manufactured by O.Z., Crouse-Hinds, Appleton or equal.
- K. Outlet, pull, and junction boxes shall be properly sealed during the course of construction to prevent the entrance of dirt and foreign materials within same or the raceway system of which it is a part. The Electrical Contractor shall provide temporary covers for all open boxes. Paper may be solidly packed into standard work boxes to prevent the entrance of dirt and foreign materials, in lieu of coverplates if so elected by the Electrical Contractor.

2.06 METAL CLAD CABLE

- A. All conductor wires and cables for secondary circuits shall consist of thoroughly tinned 98 percent conductivity copper, with 600 volt thermoplastic-covered (75 degrees C) insulation with an interlocked metal sheath, manufactured in strict accordance with the requirements of the Board of Underwriters' and the A.I.E.E..
- B. Wires, #10/2 w/GRD., #12/2 w/GRD., and #14/2 w/GRD., metal clad cable, type "MC", shall be type "THHN" solid, unless otherwise noted or shown on plans; sizes #6 AWG and larger shall be stranded Type "THHN".
- C. No wire smaller than 12/2 w/GRD., metal clad cable shall be used for any branch circuit. Larger sizes shall be used where so indicated on the plans.
- D. All wire shall be color-coded.
- E. All wire and cable shall be as manufactured by General Cable, Rome Cable, Anaconda, or approved equal.

2.07 WIRES AND CABLES

- A. Unless otherwise specified, all wires and cables shall be thoroughly tinned 98% conductivity copper, single conductor type "THHN" moisture and heat resistant polyvinylchloride thermoplastic for use at 600 volts A.C. and D.C., rated 60 degrees C. operating temperature. Wires and cables #6 AWG and larger shall be type "THHN", unless noted otherwise. The wires and cable shall have the Underwriters' Laboratories, Inc. label and be surface printed throughout the entire length at two-foot intervals with permanent identifying markings indicating manufacturer's name, size, type, and voltage. All wire and cable shall be furnished on reels or spools and in lengths required to minimize splicing.
- B. Service entrance conductors shall be "THWN" and meet all the requirements mentioned above.
- C. Fixture wiring for use on 250 volts A.C. shall be type XFF, cross linked, polyfin insulated, #14 AWG, 300 volts.
- D. Branch circuit wire in continuous raceways shall be type "THHN", heat resistant, nylon covered thermoplastic.
- E. Wires of #12, and #10 AWG shall be solid, #8 AWG and larger shall be stranded.
- F. Wires and cables #6 AWG and smaller shall be of continuous solid colors follows:

1. SYSTEM VOLTAGES: 120/208 3 PH., 4 WIRE

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Equip.Gr.	Green
2. All wires larger than #6 AWG shall be color-tape coded at all terminations.

2.08 LIGHTING FIXTURES

- A. The Contractor shall furnish and install the lighting fixtures, complete for each and every light outlet in the type quality, and size of fixture indicated on the Plans and in the Fixture Schedule, unless called for specifically to be omitted herein. It shall be the responsibility of this Contractor to check the Plans with the Schedule for completeness, as this Schedule is made up for the convenience of the Bidders. In the Schedule, Catalog Numbers are used for the purpose of indicating the general type, quality, and size of fixtures that will be required.
- B. This Contractor shall include all fixture wiring, hanging, uncrating, connecting up and making ready for operation. All fixture wire for fixtures shall not be less than #16 gauge, but larger if capacity of fixture requires it, and finished with asbestos-covered wires where exposed to excessive heat.
- C. This Contractor shall include the cost of furnishing and installing all lamps for all fixtures under this Contract throughout. All lamps for all fixtures shall be furnished in types as indicated. All lamps for Rapid-Start fixtures shall be General Electric, Westinghouse, or Sylvania, as called for under each fixture type.
- D. The Contractor shall check structural and architectural details of all locations where fixtures are to be installed so that he can properly provide for installation of the fixtures.

2.09 LIGHT SWITCHES (Commercial Spec. Grade)

- A. All local wall switches shall be of the flush Quiet toggle type, single pole, double pole, three-way or four-way, as required and as manufactured by Leviton, Hubbell, P&S or equal.
- B. All switches shall be suitable for the control of tungsten filament lamps, fluorescent loads and shall carry the proper marking of the Underwriters' Laboratories.

2.10 RECEPTACLES (Commercial Spec. Grade)

- A. All convenience outlets shall be of the single or duplex type, back or side wired, T-slot and polarized slot type. All receptacles shall be of the grounded type and be rated 15 or 20 amp as indicated. Receptacles shall be manufactured by Leviton, Hubbell, P&S or equal, but shall be of the same manufacturer as switches selected by Contractor.
- B. In general, convenience outlet circuits shall be independent of light circuits and shall not be controlled by light circuit switches or light switches, unless specifically shown.
- C. All twenty amp circuits indicated on the drawings shall be wired to twenty amp devices. The use of a fifteen amp rated receptacle on a twenty-amp circuit is not acceptable.
- D. Standard duplex receptacles specified shall be used for dual circuited receptacles by removal of break-off shunt.
- E. Bodies shall be of ivory phenolic compound, unless noted otherwise, supported by mounting yoke having plaster ears and shall be "Commercial Specification Grade". Receptacles shall be side or back wired with two screws per terminal. All receptacles shall be the grounding type and shall be connected to metal mounting yoke. A terminal shall be provided for ground wire on all receptacles.

- F. Ground Fault Circuit Interrupting (GFCI) type outlets shall be installed where indicated on the drawings. GFCI outlets shall be rated 20-amps.
- G. All bedrooms outlets shall be protected by an Arc-Fault Circuit Interrupting type device.

2.11 MISCELLANEOUS GENERAL PURPOSE DEVICES

- A. All other special and general-purpose receptacles called for on the Drawings shall be of the same grade as indicated above, ivory phenolic compound finish and manufactured by Leviton, Hubbell, P&S or equal.

2.12 DEVICE PLATES

- A. All plates used on switch and plug receptacles in finished spaces where wiring is concealed, shall be non-metallic type. Plates on exposed conduits to be sherardized. Non-metallic type shall be ivory color to match devices.
- B. Gang plates shall be used where multiple switches and/or receptacles occur at one location.
- C. Plates shall be of the same manufacturer as the wiring devices or equal.

2.13 FLUORESCENT BALLASTS

- A. All fluorescent ballasts as indicated shall be of the electronic type and their design and construction shall conform to the CBM Standards certified by ETL.
- B. The ballast fill material shall be of thermosetting type and shall not soften under failure. The ballasts shall be equipped with an internal automatic resetting thermal protector adjacent to the coils. The ballast case temperature shall not exceed 90 degrees C in continuous operation.
- C. Fluorescent ballast's shall be electronic type with full light output as manufactured by Magnetek Company or approved equal.
- D. Ballast's shall be Instant Start, Class P and shall be in accordance with the schedule set forth by the National Electrical Code.
- E. Compact Fluorescent ballasts shall be One-Lamp, Encapsulated, Electronic type. Ballasts shall be Class P with sound rating A and Automatic Resetting feature. Compact Fluorescent ballast's shall be as manufactured by Magnetek Company or approved equal.

2.14 A.C. PANELBOARDS

- A. The convertible distribution and lighting circuit breaker panelboards shall be the dead-front type and shall be in accordance with the Underwriters' Laboratories, Inc. "Standard for Panelboards", and "Standard for Cabinets and Boxes" and shall be so labeled.
 - 1. All cabinets shall be made of code gauge steel or better and if painted shall be undercoated with a rustproof bonderized surface or galvanized and treated with a non-acid agent prior to painting. Fronts, provided with doors, shall be cold-rolled sheet steel with gray finish. Directory frames shall be included on the backs of all doors. All locks shall be keyed alike. Fronts shall be furnished with approved adjustable trim clamps and means shall be provided for entrance to gutter space, lugs, etc.
 - 2. Circuit breakers shall be of the bolt-on type, stab types will not be permitted, indicating "ON-OFF" "TRIPPED" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position between an overload on one pole shall automatically cause all poles to open. Two or more single pole breakers with one handle extension will not be permitted. The circuit breakers shall be quick-break on manual, as well as automatic operation and shall have inverse time characteristics secured through the use of a bi-metallic tripping element supplemented by a magnetic trip.

Circuit breaker arc quenching shall be equal to or better than the “De-Ion” arc extinguishing principle.

3. All panelboard assemblies shall be factory assembled complete with circuit breakers as shown on the Contract Plans. Interiors shall be so designed and assembled that any individual breaker can be replaced without disturbing adjacent units or without removing main bus or branch circuit connectors. All bussing shall be heat-rated copper. Main buses and back pans of distribution and power panelboards shall be of such design that branch circuits may be changed without additional machining, drilling, or tapping. Plated contacts which meet the same values are acceptable. Lighting and power branch circuit panelboards shall be so designed that the branch circuit connections to the main bus provide sequence (fully distributed) phasing, and such connections shall be clearly and permanently identified on the face of the front of the panel interior.
- B. A.C. Power Distribution Panels shall be convertible circuit breaker distribution Panelboards Square D type “CDP” or approved equal as manufactured by I.T.E., General Electric, or Westinghouse. Frame size for each breaker shall be as shown on the Contract Plans. All bussing shall be copper. The bare, solid, copper neutral bus shall be electrically insulated from the panel and a separate, bare copper grounding bus shall be provided in each panel. Copper grounding bus shall be the equivalent of the solid neutral bus. Buses shall be clearly identified.
 - C. A.C. Lighting Panels shall be circuit breaker Panelboards Square D Type “NLAB” or approved equal as manufactured by I.T.E., General Electric, or Westinghouse. Frame size for each breaker shall be as shown on the Contract Plans. All bussing shall be copper. The bare solid copper neutral bus shall be electrically insulated from the panel and a separate, bare copper grounding bus shall be provided in each panel. Copper grounding bus shall be the equivalent size of the solid, neutral bus. Buses shall be clearly identified.

2.15 SAFETY SWITCHES AND FUSES

- A. Safety switches shall be of the fusible or non-fusible type as indicated on Drawings equipped with an external lever or handle for manual operation. Each unit shall be enclosed in a code-cage, sheet steel cabinet suitable for surface mounting as indicated on the drawings. Surface mounted units shall have hinged door and catches. Neutral conductors shall be solid throughout. Weatherproof switches shall be of the NEMA 3R type.
- B. Safety switches shall be heavy duty type as manufactured by Square D Company, General Electric Company, Westinghouse, or I.T.E.
- C. Furnish and install a complete set of fuses for installation and deliver to the Owner one set of spare fuses. Fuses shall be as manufactured by Chase Shawmut, Bussman, or Littlefuse/Tracor.

2.16 GENERAL PANEL INFORMATION

- A. All panels shall be properly balanced, the circuit numbers on the Plans being a numerical indication rather than any attempt to indicate proper balance.
- B. Care shall be taken in the use of a common neutral to make certain that no more than one leg is taken from each phase.
- C. Typed indexes shall be provided in each panel indicating circuit number and the outlets or items controlled or fed from same.

2.17 MAIN DISTRIBUTION EQUIPMENT

- A. Furnish and install the service entrance switchboard as herein specified and shown on the associated electrical Drawings. The switchboard shall meet all the requirements set forth by Underwriters’ Laboratories and shall be listed and labeled.

- B. The switchboard framework shall be fabricated on a die-formed base or base assembly consisting of formed steel and commercial channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers for mounting. The framework is to be formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment installation. Each switchboard section shall have an open bottom and individual removable top plate for installation and termination of conduit. Top and bottom conduit area is to be clearly shown and dimensioned on the Shop Drawings. The wireway front covers are to be hinged to permit access to the branch breaker load side terminals without removing the covers. All closure plates shall be screw removable and small enough for easy handling by one man. The paint finish shall be gray enamel over a rust-inhibiting phosphate primer.
- C. The switchboard bussing shall be plated copper and of sufficient cross-sectional area to continuously conduct rated full load current with a maximum average temperature rise of 65 degrees C. above an ambient temperature of 40 degrees C. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchboard. The horizontal bus bars between sections shall be located on the back of the switchboard to permit a maximum of available conduit area. The end section is to have bus bar provisions for future addition of a switchboard section. The provisions shall include the bus bars installed to the extreme side of the switchboard and pre-punched to facilitate future bolted splice plates. The horizontal main bus bar supports, connections, and joints are to be bolted with grade 5 carriage bolts and Belleville washers to be free of required periodic maintenance. The switchboard shall be bus sized and metered as shown on the Drawings.
- F. The switchboard, as a complete unit, shall be given a single integrated equipment rating to meet the available fault current as coordinated with the local utility company or a minimum of 65,000 amperes symmetrical fault current or larger as recommended by the manufacturer. The switchboard manufacturer shall certify that all equipment is capable of withstanding the stresses of a fault equal to that of the fault current mentioned above at lowest rated overcurrent protective device contained therein. Certification shall be established by factory tests done by the manufacturer on similar equipment. This test data shall be available and shall be furnished to the Engineer, if requested, with or before the submittal of approval Drawings.
- G. Integral mounted circuit breakers shall be 80% rated. Circuit breakers shall be individually insulated, braced and all connectors protected. The front faces of all circuit breakers shall be flush with each other. Equip each breaker with a circuit card holder and neatly printed card identifying the circuit. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. The entire switchboard is to be General Electric or equal.
- H. The main device shall be a three pole circuit breaker, rating as indicated on the drawing. The circuit breaker shall be General Electric "SS" Powerbreak II Series or equal.

2.18 **MOTOR WIRING**

- A. The Contractor shall do all wiring required for plumbing, ventilating and heating motors including mounting of switches and starters, as well as wiring of same. All wiring for the control of motors unless indicated on Electrical Plan, shall be provided under HVAC, Plumbing and Fire Protection.
- B. The Contractor shall furnish and install horsepower rated disconnecting means as required by the National Electrical Code for all motors. Motor-driven equipment specified under "Plumbing" and "Heating and Ventilating" may be factory wired complete with controller and motor disconnects; the Contractor shall coordinate equipment purchased under these divisions so as to provide any necessary equipment. Motor disconnects shall be unfused unless noted otherwise. Single-phase motor disconnects may be a thermal switch.

- C. Each disconnect shall be clearly labeled with a screw fastened ¼” engraved nameplate stating load controlled.

2.19 MOTOR STARTERS AND CONTROLS

- A. Motors will be furnished and installed under the respective Sections of the Specifications under which the equipment is specified.
- B. Motors ½ hp and larger will be 3 phase, 60 Hertz; motors less than ½ hp will be 120 volts, single, 60 Hertz, except specifically noted equipment.
- C. All motor starters and controls unless furnished as an integral part of the equipment, shall be provided with suitable metal enclosures and shall conform with the NEMA Industrial Control Standards.
- D. All motor starters shall have individual running overcurrent protection in each phase and shall be provided with two sets of auxiliary contacts. Starters for single phase motors shall be 2 pole and for 3 phase motors shall be 3 pole.
- E. Manual starters shall be of the toggle mechanism type for full voltage starting. Magnetic starters shall be across-the-line type, minimum size NEMA 1 equipped with Hand-Off-Automatic switch.
- F. Each motor starter and each control station shall be clearly labeled with screw fastened ¼” engraved nameplate stating equipment controlled.
- I. All motor starters shall be furnished by the mechanical contractor.

2.20 SECONDARY ELECTRICAL SERVICE

- A. Secondary electrical service shall commence at a secondary connection of utility company transformer.
- D. Electrical Contractor shall furnish and install conduit, wire, compression connectors from the secondary connections at transformer to main breaker. Sizes of which shall be indicated on the Drawings.
- E. Electrical Contractor shall utilize the existing pad mounted metering equipment panels, switches and any other equipment shown on the Drawings or herein indicated to assure a complete working system.

2.21 NAMEPLATES

- A. Nameplates shall be furnished and installed on all panelboards, pull boxes, cabinets, for all special purpose switches, motor disconnect switches, remote control stations, motor starters and other controls furnished under this Contract, to designate the equipment controlled and function. Nameplates shall be laminated black bakelite with ¼ inch high white recessed letters. Nameplates shall be securely attached to the equipment with galvanized screws or rivets.

2.22 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

- A. The Electrical Contractor shall furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting and support of all lighting fixtures and electrical equipment, to be installed under this Contract, as required.
- B. All supplementary steel, channels, and supports shall be furnished, installed, and secured with all fittings, support rods, and appurtenances required for a complete support mounting system.
- C. The type and size of the supporting channels and supplementary steel shall be determined by the Electrical Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with requirement for loading.
- D. All supplementary steel and channels shall be installed in the neat and workmanship manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 degree and 45 degree fittings, as required to suit the construction and installation conditions.

2.23 ADDRESSABLE/ANALOG FIRE ALARM SYSTEM

- A. General Requirements:
 - 1. Comply with Division 1, General Requirements and documents referred to therein.
 - 2. Provide all labor, equipment, and materials to complete the Life Safety Fire Alarm System work in accordance with local and State Regulations.
 - 3. Fire alarm system and components shall be U.L. approved and Manufactured by Gamewell Company or equal.

- B. Description of Systems:
 - 1. The Life Safety Fire Alarm System shall be a zoned, non-coded, electronically supervised, microprocessor based system. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using an integral service console or plug in programmer.
 - 2. Provide smoke and fire detection, sprinkler supervision, and automated single stage evacuation control. Interface to environmental controls and auxiliary devices.
 - 3. Provide signal appliances and signal controls for the safe and orderly evacuation of the building.
 - 4. The Life Safety System shall generally consist of the following main components:
 - a. Fire alarm control panel
 - b. addressable devices
 - c. audio visual devices
 - 5. Locate the main components and all related devices as shown on the Plans.

- C. Automatic Alarm Operations:
 - 1. Operation of an addressable alarm input device shall flash the alarm signal, and annunciate on the alphanumeric LCD 240-character display. Display the type, condition, and a location message for the first alarm immediately without the need for operator response. Capture the display to annunciate an alarm in the event the shared display is annunciating events of a lower priority or is in the site-programming mode. Turn on a red alarm LED at the control panel.
 - 2. Sort new (subsequent) events by type and log into type queues for display by emergency user selection. Sound a momentary audible signal for each event occurrence. Flash a queue LED when an unseen event exists in a queue. Update the display to annunciate the total by type and the chronological number of the event on display i.e. 3 alarm reports - #2 displayed.
 - 3. Activate the Connection to Campus Security. Signal that should be sent are; Supervisory signals, Alarm signals and Trouble signals.
 - 4. Sound the evacuation signals through out the building.
 - 5. Start an automatic alarm signal silence timer to silence all the audible alarms 10 minutes after the last alarm event. Recycle this timer for each alarm event. Turn on an alarm silenced LED while the signals are in the silence mode. Should a new alarm occur on a different zone after signal silence the alarm devices shall resound.
 - 6. Shutdown respective Air Handling Unit upon action of a duct smoke detector.
 - 7. Home the elevators to the ground floor. Once the elevators have reached the ground floor the elevator doors shall open and remain open until the system has been reset. If the ground floor is in alarm, home the elevators to the alternate floor designated by the local fire department.
 - 8. De-energize door holders to release fire doors.

- D. Non-emergency User Operations:
 - 1. Log a trouble and turn on a related LED for all user features, which modify, bypass, or inhibit the normal operations of the fire alarm life safety system. Suppress the common trouble signal during delivery of alarm signaling.

2. On the LCD, CPU, operation of the display ID code key shall annunciate the channel number and address of the currently displayed device.
 3. Operation of the menu key shall call a smart prompt program to guide the user through LCD, CPU programming operations. Restrict the use of this program by password.
 4. Operation of the Reset System push shall return the system to normal after all initiating devices have been returned to normal.
- E. Supervisory Operations:
1. Operation of an addressable supervisory input device shall flash the supervisory queue indicator, sound a momentary audible signal, and display on the alphanumeric shared display. Display the type, condition, and a location message for the first alarm immediately without the need for operator response if no fire alarms are present. Log subsequent supervisory events in the supervisory queue for display by emergency user selection. Also, display the current total number of supervisory events and the chronological number of each event. Provide supervisory alarm priority to capture the display from a trouble or monitor event. Turn on a respective amber group individual zone LED at the control panel.
- F. Quality Assurance:
1. Install in accordance with the National Electrical Code.
- G. Submittals:
1. Submit Shop Drawings for the control panel and all devices.
 2. Submit custom operational sequences for the emergency communications, peripheral devices and fire alarm common controls.
 3. Submit pictorials or photographs of control equipment overviews, modular components, and interconnecting cable charts.
 4. Provide system manuals, maintenance instructions and the name, address, and 24-hour telephone number of the service department of the SYSTEM SUPPLIER.
 5. The Electrical Contractor shall provide as-built floor plans showing all devices, control panel, and connections to mechanical equipment. Drawings shall show all conduit routing and sizes, all wire sizes, types, and numbers.
- H. Replacement of Defective Items:
1. Supply to the Architect a written agreement from the equipment manufacturer to supply new components to replace defective items without cost to the Contractor, where such defective items become evident during a period of one year from the approved certificate of completing.
- I. Control Center:
1. Provide fire alarm control panel in accordance with U.L. and N.F.P.A. requirements.
 2. The system shall be housed in a surface wall mounted Fire Red cabinet with a door and viewing windows as required. All annunciator indications, operating controls and instructions shall be clearly visible through the viewing window. The door shall be complete with a lock and two keys.
 3. All electrical connections shall be front accessible through the hinged inner door.
 4. The service console shall provide system activity LED's and event buffer display.
 5. The single person installation verification test shall allow silent and non-silent testing of all system components. In addition, it shall produce a detailed report listing relay and signal programming for each verified input.
 6. Provide the ability to use a Plug-in Field Programming / Diagnostics Tool. This tool shall allow a qualified service technician to perform multiple level programming, detailed system diagnostics and print system summary reports.
 7. Control panel shall be provided with a Radio Frequency shield to prevent interference and/or failure when fire fighting personal key two way radios.
- J. Addressable Loops (circuits)

1. Connect addressable circuits to a Loop Controller. Each control panel shall be capable of supporting up to 800 addressable devices. Provide addressable modules capable of supporting up to 253 devices. Use twisted pair data grade wire in a metallic sheath with a red stripe. Connect addressable loops Class A Style. Class B wiring shall not be acceptable.
 2. Each addressable device shall have a unique address. The manufacturer shall program each address to a system-input zone and correlate to output operations per the Plans and this Specification. Non-functioning, non-addressed and non-programmed devices shall report trouble. Provide for site modification to the addressable programming. The system shall provide for removal of devices without the necessity of readdressing any other devices. Provide installation flexibility to the contractor by insuring that the physical sequence (placement) of the devices on the loop need not determine the device address.
 3. Address and connect, addressable alarm receiving devices to the addressable loop as recommended by the manufacturer. The manufacturer shall provide installation tables to identify all device addresses.
 4. Connect each normally open sprinkler supervisory device to a dedicated addressable transponder. Annunciate each supervisory addressable input device alarm or trouble operations on the LCD. Provide an individual status LED for each supervisory device.
 5. Provide circuits to monitor auxiliary devices such as smoke dampers and fan operation as shown on the Plans. Annunciate open or on states as required. Provide an individual status LED for each circuit and display a message on the LCD display.
- K. Signal Appliance Circuits:
1. Each Output Module shall provide two power limited circuits, field programmable for any of the following operations:
 - Audible or Visual signals controlled by signal silence.
 - Audible or Visual signals controlled by system reset.
 - Remote auxiliary devices which DO or DO NOT operate in the degraded mode. This shall be determined upon field requirements and be selectable during programming.
- L. Signal Circuits:
1. Signal circuit shall be power limited audio signal circuits for each audio/visual zone. There shall be two circuits per signal circuit. Connect in a split circuit configuration.
- M. Auxiliary Relays:
1. Auxiliary relay module shall be provided with four "1C" site programmable relays.
 2. Provide auxiliary relays with switches and status LEDs to control auxiliary functions as listed in the operations and as shown on the Plans. Relays shall be dust tight with fuse protected contacts rated at 24 VDC/120 VAC, 2.5amps. Inductive at a 35 power factor. Each relay will have a follower LED which verifies operation of the relay.
- N. Transponder:
1. Provide a Gamewell Multiplex transponder in each building to connect into the exiting campus loop.
 2. Transponder shall be UL listed on NFPA 72 A, B, C, standards.
 3. Program the transponders to operate upon activation of an alarm, OR supervisory condition.
- O. Fire Alarm Common Controls and CPU:
1. Common control/CPU shall be self configurable and able to map to the display module by I/O module type. It shall have built-in field programmable software capable of being programmed and configured on site using either the built-in service console or a plug-in programming tool.

2. Provide a LCD CPU/Common Control Module with a 3 line 80 character LCD display and switches for common control, programming functions and alarm displays.
 3. Universal Display modules shall connect to the CPU and provide all zone annunciations and/or control functions. A slide in designation label shall be provided to simplify changes to zone designations.
 4. Provide the following common control switches and indicators: Alarm/City Tie Operated LED, Common Trouble LED, Power ON LED, and LED, Disable All Auxiliary Relays, Standby Power Trouble, Test All Lamps, Silence All Signals, Silence Alarm Signals, Sound Fire Drill, Sound All Clear, Ground Fault and Reset System.
 5. Provide the following features: common alarm LED, alarm signal silence inhibit LED.
 6. The LCD CPU/Common Control shall provide the following: Common Trouble LED, Power On LED, Sound Total Evacuation Switch and LED, Ground Fault, Standby Power Trouble, Test All Lamps, Silence Alarm Signals, Silence Operator Alert Signal, Silence Alarm Signals, Drill Switch, Ground Fault, Reset System.
 7. In addition, the CPU/Common Control shall provide the following: Alarm Queue Switch and LED, Display I.D. Switch, programming Menu Switch, Cancel Switch, Previous Switch, Next Switch, Enter Switch. These switches provide operator interface to the system software and function as programming keys.
 8. The Liquid Crystal Display (LCD) shall be of the super twist high contrast characters. Provide non interleaving event display by type sorting input events into queues. Types shall be fire alarm, supervisory alarm, trouble, and monitor. Provide an LED for each queue to indicate the presence of events. Provide queue select pushed to allow user selection of the event type to display. Provide previous and next pushed to allow scrolling through a list of events. Provide a full alpha numeric keypad to support site programming. Use a smart programming sequences. Initiate trouble if programming input is incomplete.
- P. System Supervision:
1. Hardware or software fault detection shall activate the audible and visual trouble indicators. Operation of the trouble silence push shall silence the audible signal, but the LED shall remain on. A new fault shall resound the signal. It shall not be possible to turn off the trouble LED until the system is clear of all faults. The common trouble circuit operation shall be independent of the CPU.
- Q. Trouble Reporting:
1. All by-pass conditions such as auxiliary or fire department by-pass.
 2. All wiring to all fire alarm devices.
 3. Power connections and data transmissions.
 4. All control panel hardware for placement.
 5. All software routines and all program data for change.
 6. All volatile memory for failure.
 7. Primary and secondary power.
 8. All field wiring for ground faults.
 9. Maintain a record in memory of fault events.
 10. Identify faults by code to simplify service trouble shooting. Standard system reset shall not erase this record.
- R. System Power:
1. Provide primary operating power of 120 Volts A.C. 60 Hz. Use modular no break system power supplies with integral battery chargers capable of recharging within 12 hours.
 2. Provide supervised secondary battery power to operate the entire system for 60 hours under normal conditions. At the end of 60 hours, the standby source shall power the system under alarm conditions for 10 minutes.
- S. System Protection:

1. Provide high voltage transient protection all circuits. Minimum protection shall be 1000V for alarm receiving, 1500V for signaling, and 2500V for power supplies.
 2. Protect sensitive electronics subject to static damage. Installer access to areas with static sensitive parts shall not be necessary.
 3. Protect controls and annunciation behind locked doors all keyed alike. Provide door windows to allow viewing of all common controls and system annunciation.
- T. Addressable Devices:
1. Provide input devices such as manual stations, smoke detectors and heat detectors with built-in addressable transponders. Set a unique address at each device.
 2. For heat detectors with fixed temperature ratings higher than 135 F, provide separately mounted transponders outside of, or away from the high heat areas.
 3. Provide separately mounted transponders for other input devices such as:
 - sprinkler flow
 - sprinkler supervisory
- U. Flow and Tamper Switches:
Flow and Tamper Switches shall be furnished and installed under division 15, wire by the Electrical Contractor. Provide Monitor module for each of these devices for addressability to Fire Alarm Control Panel.
Tamper switches shall be wired such that upon activation, an alarm signal is sent by the control panel to campus security.
- V. Addressable Pull Stations:
1. Manual Fire Alarm Stations shall be non-coded break glass type equipment with Allen head key reset. To test, the allen head latch is turned a turned and the front of the station swings down. An operated station shall automatically condition itself so as to be visually detected, at a minimum distance of one hundred feet, from front or side. Manual stations shall be constructed of formed finished aluminum, with operating directions provided on the cover in red letters. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting a standard single gang box and shall be installed not less than four and one-half feet above the finished floor. Manual stations shall be Underwriters Laboratories Listed. Provide an addressable monitor Modules with each station.
- W. Addressable Photoelectric Smoke Detectors:
1. The Contractor shall install, where indicated on the Plans, plug-in, two-wire intelligent Analog / Addressable Photoelectric type smoke detectors and matching bases. The detectors shall be the self verification type and have integral analog communications, built-in type identifications, and two blinking LEDs. The LEDs shall blink each time the device is addressed, and shall be continuously illuminated when the detector is in alarm. The detector bases shall be directly connected to an intelligent device loop for two-way communication with an interface card when configured as a control unit, or with a multiplex control panel through a addressable master card. The bases shall accommodate matching ionization and thermal detectors. The bases shall be capable of mounting to outlet or device boxes and have provisions for surface mounting. The detectors shall have a built in test switch and shall be capable of remote testing from the control panel.
- X. Addressable Heat Detectors:
1. The Contractor shall install, where indicated on the Plans, plug-in, two-wire intelligent Analog/Addressable fixed temperature heat detectors and matching bases. The detectors shall be continuously monitored to measure any change in their sensitivity due to temperature and have integral analog communications, built-in type identifications, and two blinking LEDs. The LEDs shall blink each time the device is addressed, and shall be continuously illuminated when the detector is in alarm. The detector bases shall be directly connected to an

intelligent device loop for two-way communication with an interface card when configured as a control unit, or with a multiplex control panel through an addressable master card. The bases shall accommodate matching smoke detectors. The bases shall be capable of mounting to outlet or device boxes and have provisions for surface mounting. The detectors shall have a built in test switch and shall be capable of remote testing from the control panel.

Y. Signal Appliances:

- Strobe Units

Use white wedge shaped strobes clearly labeled "FIRE". Polarize the strobes for supervised operation. Strobes shall provide a high intensity flashing light for visual signaling. Strobe units shall mount surface or flush as indicated on the plans and mount to a standard 4" x 2 1/8" back box with no extension ring required. Strobe Units shall be synchronized and comply with ADA and be UL approved. All strobe units shall be field selectable on the front of the unit with Multi-Candela settings of 15/30/75/110 candela.

- Signal Horn/Strobes

Provide white units clearly labeled "FIRE". Each device shall produce a minimum of 75 Candela with a Xenon Strobe Light and an audible signal that will produce not less than 87 dba sound output. Horn/Strobe devices shall be synchronized and comply with ADA and be UL approved. Mount devices flush or surface as indicated on the plans and mount to a standard 4" x 2 1/8" back box with no extension ring. All horn/strobe units shall be field selectable on the front of the unit with Multi-Candela settings of 15/30/75/110 candela and have at least two (2) selectable horn tones and three (3) decibel settings.

Z. Auxiliary Devices:

1. Provide remote control relays connected to supervised auxiliary circuits for control of fans, dampers, door releases, etc. Relay contact rating shall be 5 amperes at 120 VAC resistive or 2.5 amperes at 120 VAC inductive for a .5 power factor.
2. Provide flush wall mounted electromagnetic door holders. Holders shall mount to a standard single gang outlet box. Holders shall be rated 24V DC and shall release upon activation of the fire alarm system. Door holders supplied by others.
3. Beacon, provide a 24 VDC exterior Weatherproof Beacon constructed with a Lexan lens a heavy duty xenon strobe lamp. Beacon shall be similar to Amsec SL-5 or equal.

AA. Installation:

Install manual pull stations as indicated and connect to alarm circuit wiring. Mounting heights shall be as indicated on the drawings. Install automatic alarm and initiating devices as indicated and connect to alarm circuit wiring. Mounting heights and locations shall be as indicated on the drawings and coordinated with the local Fire Marshall. Install duct detectors and Remote Test Stations in HVAC equipment as indicated on the drawings. Mount at a suitable location in the return air stream prior to exhausting from the building. Mounted readily accessible for maintenance. Install audible signal devices as indicated and connect to signal circuit wiring. D.C. signal circuit wiring shall be suitable for Class II. Connect door holders to the fire alarm system such that the designated doors release upon activation of the fire alarm system. The electrical Contractor shall furnish and install a GREEN LED in the fire alarm control panel for indication, the Emergency Generator running after transferring to emergency power. All fire alarm wiring shall be Metal Clad type "MC". The contractor shall be responsible for the supply and installation of the cable, wire, wire pulling, junction boxes, electrical boxes, and terminal cabinets in

accordance with the manufacturer's recommendations. The manufacturer shall allow for the necessary amount of on site assistance for the contractor during the construction period.

BB. Verification and Certification:

The manufacturer shall make an inspection of the Life Safety equipment. The inspection shall include all equipment necessary for the direct operation of the system such as input and output devices. Verify wiring connections to ensure that all equipment meets applicable codes and standards. Verify equipment supplied by the manufacturer has been installed per the manufacturer's recommendations. Verify the operation of all devices. Verify the wiring to all supervised devices is supervised.

PART 3.00 – EXECUTION

3.01 GENERAL PROVISIONS

- A. All locations of equipment and materials are subject to review by the Architect in order to coordinate with field conditions.

3.02 TESTS

- A. The right is reserved to conduct acceptance tests of all equipment wiring or any other work furnished under these Drawings and/or Specifications to determine the fulfillment of specific requirements and/or design.
- B. The Contractor shall perform all tests, supply all instrumentation, personnel and make all adjustments of equipment and wiring as may be necessary. Insulation resistance readings of all equipment and circuits shall be taken by the Contractor in the presence of the Owner's representative. Megger readings of less resistance than the recommended minimum as called by Section 110-7 of the NEC shall be required or replaced by this Contractor at no cost to the Owner.

3.03 GROUNDING

- A. The Contractor shall furnish and install all material required for grounding and/or bonding in the building of all equipment, power systems, all as shown on the Drawings and/or specified, as a minimum.
- B. Grounding shall conform to NEC Article 250.

3.04 INSTALLATION OF WIRING AND CONDUIT

- A. In general, all wiring is to be run concealed unless otherwise indicated to be run exposed. Exposed wiring in the mechanical spaces is acceptable.
- B. Raceways shall be continuous from outlet to outlet and from outlets to cabinets, junction and pull boxes, and shall enter and be secured to all boxes in such manner that each system shall be electrically continuous from service to all outlets. Terminal of all conduits shall be furnished with double locknuts and bushings.
- C. Exposed conduits shall be run parallel to or at right angles to the wall of the buildings, and all bends shall be made with standard ells or bent to not less than the same radius. Horizontal runs of exposed conduits shall be close to ceilings, passing over water or other piping where possible and shall be supported by pipe straps or by other approved means, not more than five feet apart.
- D. In no place shall conduit be run within six inches of hot water pipes or appliances, except where crossing is unavoidable, and in that case the conduit shall be kept at least one inch from covering of pipe crossed.
- E. Conduits shall be supported on approved types of galvanized wall brackets, ceiling trapeze, strap hangers or pipe straps, secured by means of toggle bolts on hollow masonry, machine screws on metal surfaces or wood screws on wood construction. No nails shall be used as a means of fastening boxes or conduit.
- F. In general, no splices or joints will be permitted in feeder cables, and branches shall be spliced at outlets or accessible junction boxes.

- G. All splices in wire #6 AWG and smaller shall be standard pig-tail made mechanically tight, then cleaned, and insulated with proper layers and thickness of rubber and friction tape. Wire splicing nuts, Thomas and Betts, Sta-Kon or Minnesota Mining and Manufacturing Co., Scotchlock Type R, may be used subject to approval of the local inspector. Joints, tape and splices in wire #6 AWG and larger shall be taped with approved rubber and friction tapes providing insulation not less than that of the conductor over Burndy Servits or equivalent connectors made by Penn Union or Blackburn.
- H. Wire #6 AWG and larger shall be connected to panels and apparatus by means of approved lugs and connectors. Connectors shall be solderless type, sufficiently large to enclose all strands of the conductor and securely fastened.
- I. Wiring method shall conform to local wiring inspector. Prior to submitting bid, Contractor shall confirm wiring method to be allowed by local ordinances.

3.05 INSTALLATION OF OUTLET BOXES

- A. Outlet boxes shall be of size and type to accommodate structural conditions; size and number of raceways; conductors or cables entering; and device or fixture for which required.
- B. Install blank plates on all outlet boxes in which no apparatus is installed, which do not integrally provide a cover for box.
- C. Special care should be taken to set all boxes correctly, square and true with the building finish. The edge of the box shall come flush with the building finish. As far as possible, all wall and switch outlets shall be erected in advance of furring and fireproofing and shall be secured to the building structure or steel by adjustable strap iron supports, which shall be buried.
- D. The exact location of all outlets and switches in finished rooms shall be obtained from the Architect and from the scale drawings of interior details and finish. Final correct readjustment shall be made to outlets, if necessary, to give proper centering.
- E. The locations given or designated on the Plans for the outlets are subject to notifications. In the case of local wall switches to be set at or near doors, the definite location shall be as established on the side of the door opposite the hinge.

3.06 JUNCTION AND PULL BOXES

- A. Junction and pull boxes shall be furnished and installed under this Section of the Specification where indicated on the Drawings and wherever else such a box may be deemed necessary to facilitate the pulling or splicing of wire and cable.
- B. All such boxes must be made accessible and shall be built only from the approved detail working Drawings. Conduits shall enter these boxes through tight-fitting clearance holes.
- C. The covers of the boxes shall be designed for quick removal. Where junction boxes are required for a splicing box for special recessed fixtures, consult the Architect before installing boxes for these fixtures and determine the exact location of the boxes.
- D. Each feeder passing through a pull box shall meet the approval of the Architect. Generally, junction boxes and pull boxes shall not be exposed in finished areas; where necessary, reroute conduits or make other arrangements to meet the approval of the Architect.

- E. Outlet, pull and junction boxes shall be properly sealed during the course of construction to prevent the entrance of dirt and foreign materials within same or the raceway system of which it is part. The Electrical Contractor shall provide temporary covers for all open boxes. Paper shall be solidly packed into standard work boxes to prevent the entrance of dirt and foreign materials, in lieu of cover plates if so elected by the Electrical Contractor.

3.07 LIGHT SWITCHES

- A. In general, convenience outlet circuits shall be independent of light circuits. In all cases the light switches shall be located opposite hinge side of door, per latest Architectural Drawings

3.08 GENERAL PANEL INFORMATION

- A. All panels shall be properly balanced, the circuit numbers on the Plans being a numerical indication rather than any attempt to indicate proper balance.
- B. Care shall be taken in the use of a common neutral to make certain that no more than one leg is taken from each phase.
- C. Typed directories shall be provided in each panel indicating circuit number and the outlets or items controlled or fed from same.

3.09 MOTOR WIRING

- A. The Contractor shall do all wiring required for plumbing, ventilating and heating motors including mounting of switches and starters, as well as wiring of same. All wiring for the control of motors, unless indicated on Electrical Plans, shall be indicated in HVAC, Plumbing and Fire Protection Sections.
- B. The Mechanical Contractor shall furnish starters to be installed by the electrical contractor. The electrical contractor shall furnish and install fused disconnecting means as required by the National Electrical Code for all motors. Motor-driven equipment specified under "Plumbing" and "Heating and Ventilating" may be factory wired complete with controller and motor disconnects; therefore, the Contractor should check equipment purchased under these divisions so as to avoid duplication of protective and disconnecting means. Motor disconnects shall be fused unless noted otherwise. Single phase disconnects may be thermal switches.
- C. The Contractor shall furnish and install a fused disconnect at each HVAC unit. Fusing shall be per manufacturer's recommendation. Prior to wiring HVAC units, Contractor shall review submittals on equipment for electrical characteristics.

3.10 VOICE/DATA AND COAX TV CABLING

- A. The General Contractor shall furnish and install a fire rated plywood backboard for future tel/data equipment.
- B. Contractor shall furnish and install incoming raceways to the main tel/data room as indicated on the drawings. The exact location of the conduit system shall be determined in field.

3.11 FIRE ALARM SYSTEM

- A. INSTALLATION
 - 1. Fire alarm system shall be wired in accordance with manufacturer's complete Wiring Diagram as submitted with Shop Drawings.

2. Power limited fire alarm cable shall be utilized for wiring system components associated with the SLC loops.
3. Provide two complete Wiring Diagrams and maintenance manuals to be turned over to Owner. Provide one additional Wiring Diagram and maintenance manual in control panel.
4. Entire system shall be guaranteed for one year after final acceptance.
5. Provide and install the system in accordance with the Plans and Specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC-Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required, may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the Contractor shall so certify in writing to the Owner and General Contractor. All junction box covers shall be painted red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
6. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Subcontractors.
7. The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
8. The manufacturer's authorized representative shall provide onsite supervision of installation.

B. TESTING

1. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the Contractor. Upon completion of a successful test, the Contractor shall so certify in writing to the Owner and General Contractor.

C. WARRANTY

1. The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one year from the date of first beneficial use.
2. The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with NFPA-72H guidelines.

D. GENERAL

1. The work covered by this Section of the Specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm System as shown on the Drawings and as herein specified.
2. The requirements of the conditions of the Contract, Supplementary conditions and General Requirements apply to the work specified in this Section.
3. The complete installation shall conform to the applicable sections of NFPA-72 (A), (B), (C), (D), (E), (F), Local Code Requirements and National Electrical Code with particular attention to Article 760.
4. The work covered by this Section of the Specifications shall be coordinated with the related work as specified elsewhere under the project Specifications.

E. QUALITY ASSURANCE

1. Each and all items of the fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by

Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall not be acceptable.

2. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC Article 760-23.

3.12 QUIET OPERATION

- A. All equipment and material furnished by this Contractor shall operate under all conditions of load without objectionable noise or vibration, which in the opinion of the Architect is objectionable. Where sound or vibration conditions occur, which the Architect considers objectionable, this Contractor shall eliminate same in a manner approved by the Architect.

3.13 RECORD DRAWINGS

- A. A set of as-built Record Drawings, consisting of a reproducible set of Architect's Drawings with additional sketches as required, denoting and dimensioning accurately all changes in elevation location and size of material deviating from the Architect's Drawings, shall be kept concurrently with the progress of the installation. Upon completion of the work, the Contractor shall deliver to the Architect an up-to-date set of these as-built Record Drawings.

SECTION 211100 – FIRE SUPPRESSION PIPING

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 the following fire-suppression piping inside the building:
 - 1. Automatic or manual wet-type, Class I standpipe systems.
 - 2. Wet-pipe sprinkler systems.
- B. Related Sections include the following:
 - 1. Division 2 Section "Water Distribution" for piping outside the building.

1.3 DEFINITIONS

- A. Underground Service-Entrance Piping: Underground service piping entering the building.

1.4 SYSTEM DESCRIPTIONS

- A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.
- B. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
- C. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.
- D. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:
 - a. NPS 2-1/2 Hose Connections: 100.0 psig or lower pressure, 65.0 psig minimum, as directed by the authorities having jurisdiction.
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction and FM Global.

1. Margin of Safety for Available Water Flow and Pressure: 10 PSI, including losses through water-service piping, valves, and backflow preventers.
 2. Maximum velocity in the sprinkler system shall not exceed 20.0 FPS.
 3. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. General Storage Areas: Ordinary Hazard, Group 1.
 - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. Office and Public Areas: Light Hazard.
 - e. Ordinary Hazard, Group 1.
 4. The following is a list of the minimum Density for Automatic-Sprinkler Piping Design. The Insurance Underwriter for this project may require different densities, which must be verified and followed.
 - a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 2500-sq. ft..
 - b. Special Occupancy Hazard: As determined by authorities having jurisdiction.
 5. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 168 sq. ft.
 - b. Storage Areas: 130 sq. ft.
 - c. Mechanical Equipment Rooms: 130 sq. ft.
 - d. Electrical Equipment Rooms: 130 sq. ft.
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13, and shall also comply with the IBC Building Code/2006 and State Building Code, "Minimum Design Loads for Buildings and Other Structures", "Earthquake Loads."

1.6 SUBMITTALS

- A. Product Data: For the following:
1. Piping materials, including sprinkler specialty fittings.
 2. Pipe hangers and supports, including seismic restraints.
 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim, and backflow preventer device.
 4. Mechanical pipe and expansion joint fittings.
 5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 6. Hose connections, including size, type, and finish.
 7. Fire hose cabinets.
 8. Pipe and valve identification.
 9. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 10. Alarm devices, including flow, supervisory and pressure switches, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Approved Sprinkler and Standpipe Piping Drawings: Working plans, prepared according to NFPA 13 and NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance

requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

- E. Welding certificates.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
 - 3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that attach to or penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Manufacturers must be ISO certified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Grooved-End, Cement Lined, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.
 - 1. Grooved-Joint Piping and Fitting Systems:
 - a. Manufacturers:
 - 1) Victaulic Co. of America.
 - b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD and cement lining.
 - c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
 - d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
 - e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3.
 - 2. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 - 3. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Victaulic Co. of America.
 - 3) Ward Manufacturing.
- B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Grinnell Corporation
 - 2) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

- C. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 with factory, roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Grinnell Corporation.
 - 2) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe O.D. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.
1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epcos Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- C. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
 - a. Advance Products and Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- D. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.
1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- E. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.
1. Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.5 FLEXIBLE CONNECTORS

- A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
1. NPS 2 and Smaller: Threaded.

2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Mercer Rubber Co.
4. Metraflex, Inc.
5. Proco Products, Inc.
6. Unaflex Inc.

- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

2.6 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 300-psig working-pressure rating if fittings are components of high-pressure piping system.

- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

- a. Victaulic Co. of America.
- b. AGF Manufacturing Company.
- c. Sure Test.

- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

- a. Elkhart Brass Mfg. Co., Inc.
- b. Fire-End and Croker Corp.
- c. Potter-Roemer; Fire-Protection Div.

- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

- a. AGF Manufacturing Co.
- b. Sure Test.
- c. Victaulic.

- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

- a. CECA, LLC.
- b. Merit.

2.7 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.

- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 3. Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.
- C. Butterfly Valves: UL 1091.
1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Mueller Company.
 - 3) Victaulic Co. of America.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
1. Manufacturers:
 - a. Fairbanks
 - b. Jenkins
 - c. Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
 - d. Stockham
 - e. Viking Corp.
- E. Gate Valves: UL 262, OS&Y type.
1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Fairbanks
 - 2) Jenkins
 - 3) Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
 - 4) Stockham
 - 5) Viking Corp.
 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) Fairbanks
 - 2) Jenkins
 - 3) Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
 - 4) Stockham
 - 5) Viking Corp.
- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
 2. NPS 2 and Smaller: Ball valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) Victaulic Co. of America.
 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; LVG type or with flanged or grooved ends.

- a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Milwaukee Valve Company.
 - 3) Victaulic Co. of America.

2.8 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.9 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.
 1. Manufacturers:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Victaulic Co. of America.
 - c. Viking Corp.
 2. Wet Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- B. Dry-Pipe Valves: UL 260, differential type; with bronze seal with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 1. Air-Pressure Maintenance Device: UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig maximum inlet pressure.
 - a. Manufactures:
 - 1) Central Sprinkler Corp.
 - 2) General Air Products, Inc.
 - 3) Reliable Automatic Sprinkler Co., Inc.
 - 4) Viking Corp.
 - 5) Victaulic.
 2. Riser-Mounted Air Compressor: UL 753, fractional horsepower, 120-V AC, 60 hZ, single

phase.

a. Manufacturers:

- 1) Reliable Automatic Sprinkler Co., Inc.
- 2) Viking Corp.
- 3) General Air Products, Inc.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

- a. AFAC Inc.
- b. Grinnell Fire Protection.

2.10 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 300-psig pressure rating if sprinklers are components of high-pressure piping system.

B. Manufacturers:

1. Automatic Sprinkler Corp of America
2. Guardian Automatic Sprinkler Co., Inc.
3. Reliable Automatic Sprinkler Co., Inc.
4. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Pendent sprinklers.
3. Pendent, dry-type sprinklers.
4. Quick-response sprinklers.
5. Upright sprinklers.
6. Sidewall, dry-type sprinklers.

F. Sprinkler Finishes: White painted in finished areas, exposed to view, rough bronze finish for heads in unfinished spaces and not exposed to view.

G. Special Coatings: Wax-coated where installed exposed to acids, chemicals, or other corrosive fumes.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.11 HOSE CONNECTIONS

- A. Manufacturers:
 - 1. Guardian Fire Equipment, Inc.
 - 2. United Brass
 - 3. Viking Corp.

- B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; NPS 2-1/2" and lugged cap, gasket, and chain. Include NPS 2-1/2" as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Nonadjustable type.
 - 2. Finish: Rough chrome-plated.

- C. Valve Cabinet Description:
 - 1. Cabinet Material: Enameled steel sheet.
 - 2. Type: Fire hose valve.
 - 3. Mounting: Flush recessed.
 - 4. Door prime-coated steel with double strength full panel glass and pull handle.
 - 5. Cabinet Size: 18" x 18" x 8" for single valve with NPS 2-1/2".

2.12 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
 - 1. Guardian Fire Equipment, Inc.
 - 2. United Brass
 - 3. Viking Corp.

- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; Chrome, flush wall type, with wall escutcheon. Connection size shall be 4 inch Storz. Wall escutcheon shall have words similar to "AUTO SPKR & STANDPIPE -FIRE DEPARTMENT CONNECTION" or "STANDPIPE – FIRE DEPARTMENT CONNECTION" or " AUTO SPKR – FIRE DEPARTMENT CONNECTION" or " Manual Standpipe – Fire Department Connection".
 - 1. Type: Flush, with round escutcheon plate.
 - 2. Finish: Polished chrome-plated.

2.13 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.

- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.
 - 1. Manufacturers:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Viking Corp.

- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.

- D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
- E. Low Pressure Supervisory Switch: Electrical-supervision-type, waterflow switch with retard feature. Adjustable between 10 psi – 175 psi. Pressure switch shall operate with two sets of SPDT contacts.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
- F. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
- G. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.

2.14 PRESSURE GAGES

- A. Manufacturers:
 - 1. AGF Manufacturing Co.
 - 2. AMETEK, Inc.; U.S. Gauge.
 - 3. Dresser Equipment Group; Instrument Div.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.
 - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 - 2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 2 for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Ductile-iron, cement lined, class 52, mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.5 FIRE PROTECTION SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Fire Protection System, 175-psig Maximum Working Pressure:
 - 1. NPS 2 and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. NPS 2-1/2 to NPS 10: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and roll grooved joints. Wall thickness per NFPA requirements.
- B. Standard-Pressure, Dry-Pipe System, 175 psig, Maximum Working Pressure:
 - 1. NPS 1-1/2 and Smaller: threaded-end, galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints. All materials to be galvanized.
 - 2. NPS 2: Grooved-end, galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end pipe couplings; and grooved joints. All materials to be galvanized.

3.6 STANDPIPE SYSTEM PIPING APPLICATIONS

- A. Standard Pressure, Wet Type Standpipe System, 175-psig, Maximum Working Pressure;
 - 1. NPS 4: Threaded end, standard weight steel pipe; cast or malleable iron threaded fittings; and threaded joints.
 - 2. NPS 4: Grooved end, black standard weight steel pipe with roll grooved end fittings; grooved end pipe couplings; and grooved joints.
 - 3. NPS 4: Grooved end, black Schedule 30 steel pipe; grooved end fittings; grooved end pipe couplings; and grooved joints.
 - 4. NPS 6: Grooved end, black standard weight steel pipe with roll grooved end fittings; grooved end fittings; grooved end pipe couplings; and grooved joints.
 - 5. NPS 6: Grooved end, black Schedule 30 steel pipe; grooved end fittings; grooved end pipe couplings; and grooved joints.

3.7 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.8 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
 - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - 1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 - 2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.9 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, pressure switch, flow switch, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.

3.10 PIPING INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location

and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground ductile-iron, cement lined service-entrance piping according to NFPA 24 and with restrained joints.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install drain valves on standpipes.
- K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- L. Install alarm devices in piping systems.
- M. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 1. Install standpipe system piping according to NFPA 14.
 2. Install sprinkler system piping according to NFPA 13.
- N. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- P. Fill wet-standpipe system piping with water.
- Q. Fill wet-pipe sprinkler system piping with water.

3.11 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water

supply except from fire department connections and fire pump test headers and elsewhere required. Install permanent identification signs indicating portion of system controlled by each valve.

- C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.
- D. Install backflow preventers in potable-water supply sources.
- E. Specialty Valves:
 - 1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.12 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used.
- B. Temperature ratings of heads in machine rooms, kitchens, storage rooms, unventilated spaces, mechanical rooms, electrical rooms, unventilated attic spaces, ceiling spaces, crawl spaces and tunnels and in any areas where ceiling temperature is expected to exceed 100°F shall be intermediate temperature classification. Heads near high temperature equipment and piping shall have temperature rating as required by NFPA 13. Temperature classifications for other heads shall be ordinary temperature classification, unless otherwise noted.
- C. For exposed pipe installations, heads shall be brass: Reliable Model GFR (Quick-Response).
- D. For installation in finished ceilings, concealed heads shall be factory painted white, adjustable: Reliable Model G4A (Quick-Response).
- E. For installation in finished ceilings, pendent heads shall be factory painted white with matching escutcheon: Reliable Model GFR (Quick-Response).
- F. Horizontal sidewall heads in finished areas shall be bright chrome plated, with matching escutcheon: Reliable Model GFR (Quick-Response).
- G. Vertical pendent sidewall heads in finished areas shall be factory painted white with matching escutcheon: Reliable Model F1FR (Quick-Response, for light hazard only).
- H. Dry pendent heads shall be bright chrome-plated, with recessed escutcheon; Reliable Model F3QR (Quick-Response, for light and ordinary hazard). In all cold rooms such as coolers, provide EPDM, 50 Durometer-Type rubber boot to prevent condensation formation: Tyco Model DSB-1.
- I. Dry horizontal sidewall heads, for installation at 4"-12" below ceilings and obstructions, shall be factory painted white with matching escutcheon: Reliable Model F3QR (Quick-Response, for light and ordinary hazards).
- J. In areas where heads are subject to physical damage, provide sprinkler guard assembly over head: Reliable Model C-1 or Reliable Model C-2 for dry heads. This shall include but not be limited to:
 - 1. Heads in elevator shafts
 - 2. Heads under lower rakes of stairways
 - 3. Heads in electrical rooms
 - 4. Heads in machine rooms

5. Heads in boiler rooms and other mechanical rooms
 6. Heads installed 7'-0" or less above finished floor
 7. Heads located in cold rooms
- K. When pendent sprinkler heads are installed adjacent to vertical obstructions such as surface-mounted light fixtures, provide matching two-piece extension escutcheons: Reliable Model HB with chrome finish.
- L. Furnish minimum six spares of each style and type of head; furnish sprinkler wrench and storage cabinets. Furnish additional quantities if required by Code. Storage cabinet shall be steel with red finish: Potter-Roemer #6162.
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers, as indicated.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Pendent, dry sprinklers, Sidewall, dry sprinklers as indicated.
 5. Special Applications: Quick-response sprinklers where applicable by NFPA13 and IBC.
 6. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - e. Residential Sprinklers: Dull chrome.

3.13 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center (in both directions) of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.14 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2, unless otherwise indicated.
- C. Install wall-mounting-type hose connections in flush recessed cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose.

3.15 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type Storz, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.16 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- F. Electrical Connections: Power wiring is specified in Division 16.
- G. Connect alarm devices to fire alarm.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding."
- I. Connect wiring according to Division 26 Section "Conductors and Cables."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.17 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 23 Section "Mechanical Identification."

3.18 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Start and run air compressors.
 - 5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 6. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 7. Coordinate with fire alarm tests. Operate as required.
 - 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.19 CLEANING AND PROTECTION

FIRE SUPPRESSION PIPING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

3.20 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 1 Sections "Conditions of the Contract" and "Supplementary Conditions".

END OF SECTION 211100

SECTION 31 10 00

SITE CLEARING

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 the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place removing site utilities].

- B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
2. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
3. Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.
4. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings or structures undergoing alterations.
5. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
6. Division 23 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and friable sand, silt, and clay particles found in a depth of not less than 4 inches; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Owner's Representative.
 - 1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Owner's Representative.

3.3 UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures to remain before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed and abandoned.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 02, Sections covering site utilities.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Unsound or unsightly branches of trees and shrubs designated to remain, and not specified to be removed under another item shall be removed as directed. All such removing and the disposal shall be a part of and incidental to this item
 - 3. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 4. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 5. Use only hand methods for grubbing within tree protection zone.
 - 6. Chip removed tree branches and stockpile in areas approved by Owner's Representative dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

- A. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- B. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system
- C. Stockpile topsoil materials away from edge of excavations, or where directed, without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover or mulch to prevent windblown dust.
 - 1. Do not stockpile topsoil within tree protection zones.
 - 2. Dispose of excess topsoil as specified for waste material disposal.
 - 3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property. Disposal may be by depositing in off-site waste disposal areas approved by the Owner's Representative, or by chipping.

END OF SECTION

SECTION 312000

EARTH MOVING

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 the following:

1. Preparing subgrades for walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for concrete walks pavements.
4. Subbase course for unit paver walks.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.
7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

- B. Related Sections include the following:

1. Division 01 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
2. Division 01 Section "Unit Prices" for unit-price excavation and authorized additional excavation provisions.
3. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
4. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
5. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
6. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
7. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
8. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
9. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
10. Division 33 Section "Subdrainage" for drainage of foundations slabs-on-grade walls and landscaped areas.

11. Report on subsurface explorations and foundation design, by Haley and Aldrich dated 10 November 2006.

C. Note: Where conflicts exist between this specification and the Haley and Aldrich Report reference above, Haley and Aldrich report governs.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner's Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile (if needed)
 - 2. Controlled low-strength material, including design mixture.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698, ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
 - 3. Recent gradation of each on-site and borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Use of Explosives: Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
- B. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- C. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's Representative's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

- C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with Owner and utilities companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

2.2 SOIL MATERIALS FOR ROADWAYS AND PARKING LOTS

- A. Aggregate Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand which are free from vegetable matter, lumps, or balls of clay, and other deleterious substances with no particles of rock that will not pass the 6-in. square mesh sieve. The gradation of the portion which will pass a 3-inch sieve shall meet the grading requirements of the following table:

<u>Sieve Designation</u>	<u>Percent by Weight Passing Square Mesh Sieve</u>
1/4 inch	25-70
No. 40	0-30
No. 200	0-7

- B. Aggregate Base Course: Naturally or artificially graded mixture of crushed gravel, crushed stone, and crushed sand which are free from vegetable matter, lumps or balls of clay, and other deleterious substances. The gradation of the base materials shall meet the grading requirements of the following table:

<u>Sieve Designation</u>	<u>Percent by Weight Passing Square Mesh Sieve</u>
2 inch	100
1/2 inch	45-70
1/4 inch	30-55
No. 40	0-20
No. 200	0-5

2.3 SOIL MATERIALS FOR STRUCTURES

- A. Structural Fill (under concrete slabs and footings): Refer to structural specifications and the geotechnical report.
- B. Granular Fill (Placed within the zone of influence footings, adjacent to foundation walls, beneath walks and drives): Refer to geotechnical report.

- C. Structural Backfill (placed within 5 feet of drainage and sewer structures): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand which are free from vegetable matter, lumps, or balls of clay, and other deleterious substances. The gradation shall meet the grading requirements of the following table:

<u>Sieve Designation</u>	<u>Percent by Weight Passing Square Mesh Sieve</u>
6 inch	100
1/4 inch	25-70
No. 40	0-30
No. 200	0-5

2.4 PIPE BEDDING MATERIALS

- A. Granular Pipe Bedding Material: Shall be clean and free of organic matter, silt, or clay lumps, and deleterious materials. The material shall meet the following gradation requirements:

<u>Sieve Designation</u>	<u>Percent by Weight Passing Square Mesh Sieve</u>
1/2 inch	100
No. 4	95-100
No. 40	20-45
No. 200	0-5

- B. Stone Pipe Bedding Material: Shall be screened or crushed stone free of organic matter, silt, or clay lumps, and deleterious material. The material shall meet the following gradation requirements:

<u>Sieve Designation</u>	<u>Percent by Weight Passing Square Mesh Sieve</u>
1 inch	100
1/4 inch	0-5

2.5 ON-SITE MATERIALS

- A. Material on the site is the property of the Owner and shall be incorporated in the work if possible. The Owner's Representative shall classify the material under Article 2.01 headings. Any sample testing needed for this classification will be performed by an approved laboratory at the Owner's expense.
- B. Material not incorporated in the work because it is unsuitable will be hauled away and disposed of at the Contractor's expense.
 - 1. Material designated to be wasted by the Owner's Representative will be disposed of by the Contractor.

2. Material designated to be saved by the Owner's Representative will be stockpiled at a location shown on the drawings or designated by the Owner's Representative.
3. Unsuitable material shall consist of grubbings or other materials which contain rock of size exceeding specifications, organic materials, or other materials of a deleterious nature as deemed by the Owner's Representative.

2.6 MISCELLANEOUS MATERIALS

- A. Common Borrow: Shall be earth, suitable for embankment construction. It shall be free of frozen material, perishable rubbish, peat, organic matter, large rock fragments, or other unsuitable material. AASHTO M145 "The classification of soils and soil aggregate mixtures for highway construction purposes AASHTO Designation M145-82 Part 1 Specifications latest edition Classifications A-1 through A-5 may be used. Use of other materials as common borrow is at the discretion of the Owner's Representative and only in approved areas.
- B. Gravel Borrow: Shall consist of uniformly graded granular material having no rocks with a maximum dimension of over 6 in. and that portion passing a 3-in. square mesh sieve shall contain not more than 70 percent passing a 1/4 - in. mesh sieve and not more than 10 percent passing a No. 200 mesh sieve.
- C. Rock Borrow: Shall consist of hard durable rock broken to various sizes that will form a compact embankment with a minimum of voids. The maximum size for any rock shall be 3 feet in its greatest dimension.
- D. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- E. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- F. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- G. Topsoil (Loam): Shall be in accordance with Division 32 Section Turf and Grasses.
- H. Satisfactory Excavated Material (Onsite): Shall conform to the requirements of Common and/or Impervious Borrow as a minimum as determined by the Owner's Representative and be of an appropriate water content to facilitate obtaining the required compaction.

2.7 GEOTEXTILES

1. Subsurface Drainage Geotextile: Mirafi 140N or equivalent.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
 3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
 4. Tear Strength: 90 lbf (400 N); ASTM D 4533.

5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.8 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material (Flowable Fill): Low-density, self-compacting, flowable concrete material as follows:
 1. Portland Cement: ASTM C 150, Type I, II, or III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) 3/8-inch (10-mm) nominal maximum aggregate size.
 4. Water: ASTM C 94/C 94M.
- B. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

2.9 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Erosion Control" during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system, specified in Division 31 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches (150 mm) beneath bottom of concrete slabs on grade.
 - f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Owner's Representative. Changes in the Contract time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- C. Excavation of Unsuitable Material: Excavate and remove all fill materials including loose, uncompacted soils material, buried vegetation and other organic or inorganic debris shown on the plans, encountered during the prosecution of the work, or as directed by the Owner's Representative. The excavation shall extend to the limits and depth necessary to remove all fill and unsuitable native material.
- D. Muck Excavation: Excavate and dispose of saturated and unsaturated mixtures soils and organic matter not suitable for foundation or embankment material, regardless of moisture content.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1/2 inch (13 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or

minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades, within a vertical tolerance of one (1) in.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations, within a vertical tolerance of one (1) in.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: Excavate to the uniform width shown or required for the particular item to be installed. Provide adequate working space for compactive equipment.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material and backfill with a 6" layer of crushed stone or gravel prior to installing pipe.

3.8 SUBGRADE INSPECTION

- A. Notify Owner's Representative when excavations have reached required subgrade.
- B. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade pavement with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting and backfilling of voids with satisfactory materials. Temporary sheet piling driven below bottom of structures shall be removed in manner to prevent settlement of the structure or utilities, or cut off and left in place if required.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Trench excavations in public streets and other confined areas where trench walls cannot be sloped must be supported by sheeting, shoring, or other methods acceptable to meet the requirement that the Contractor provide inspection of excavations.
- B. In pipe trenches, use material specified in typical trench section.
- C. Place backfill on subgrades free of mud, frost, snow, or ice.
- D. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- E. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- F. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.
- G. Place and compact initial backfill free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- H. Controlled Low-Strength Material (Flowable Fill): Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- I. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- J. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- K. Controlled Low-Strength Material (Flowable Fill): Place final backfill of controlled low-strength material to final subgrade elevation.
- L. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory excavated or borrow material.
2. Under walks and pavements, use material specified in the typical pavement section, and identified in Article entitled "Soil Materials for Roadways and Parking Lots".
3. Under steps and ramps, aggregate subbase material.
4. Under footings and foundations, use structural fill material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten subgrade and each subsequent fill or backfill soil layer in proper quantities to prevent free water appearing on surface during or subsequent to compaction operations to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit density according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Adjacent to Structures: Compact each layer of backfill or fill soil materials at 95 percent.
3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 93 percent.
4. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
5. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1/2 inch.

3.17 PAVEMENT SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), ASTM D 2922 (Nuclear Device), as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests
 2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained at no additional cost to the Owner.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Owner's Representative; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Owner's Representative.
1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 23 19

DEWATERING

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 construction dewatering.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
 - 2. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Remove dewatering system when no longer required for construction.
- B. The Contractor shall make provisions on the site to detain and filter water from the excavation operation so that sediments from the dewatering operation are contained. In no case will direct discharge from the dewatering operations to off-site drainage facilities be allowed.
- C. Sediment Control Guidelines:
 - 1. U.S. Environmental Protection Agency Publication 430/9-73- 007 Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity.
 - 2. Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices. Department of Environmental Protection 1991.

1.4 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 1. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to dewatering including, but not limited to, the following:
 - a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
 - b. Geotechnical report.
 - c. Proposed site clearing and excavations.
 - d. Existing utilities and subsurface conditions.
 - e. Coordination for interruption, shutoff, capping, and continuation of utility services.
 - f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - g. Testing and monitoring of dewatering system.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering

requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION

SECTION 31 50 00

EXCAVATION SUPPORT AND 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 temporary excavation support and protection systems where called for on the drawings, where directed by the Owner's Representative for protection of structures and where required to meet safety requirements of the U.S. Department of Labor's Construction Safety Act designated as Title 29-LABOR-Part 1926 Safety and Health Regulations for Construction, Subpart P, Sections 926.650 through 653.
- B. Trench excavations in public streets and other confined areas where trench walls cannot be sloped must be supported by sheeting, shoring, or other methods acceptable to meet the requirement that the Contractor provide inspection of excavations.
- C. Related Sections:
 - 1. Division 31 Section "Dewatering" for dewatering system for excavations.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, furnish, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system. Submit at least ten (10) days prior to beginning related construction.

- B. [Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Coordination with waterproofing.
 - h. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's Representative's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. The Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is included elsewhere in the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
 - 1. Corners: Site-fabricated mechanical interlock or roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install walls horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
 - 3. Repair or replace, as approved by Owner's Representative, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION

SECTION 321216
ASPHALT PAVING

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. Hot-mix asphalt patching.
- 2. Hot-mix asphalt paving.

B. Related Sections:

- 1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
- 2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

- 1. Submit laboratory test reports of the stockpiled aggregates initially used in the mix and additional test reports for each change of source.
- 2. Submit laboratory test reports for asphalt cement used in the initial mix and additional test reports for each change of source.
- 3. Submit design mix.

- B. Qualification Data: For qualified manufacturer.

- C. Material Test Reports: For each paving material.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Maine Department of Transportation.

- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Maine Department of Transportation Standard Specifications for asphalt paving work.

1.5 PROJECT CONDITIONS

- A. For weather limitations the State will be considered to be divided into 2 paving zones.
 - 1. Zone 1 – All area north of U.S. Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
 - 2. Zone 2 – All area south of Zone 1 including the U.S. Route 2 and Route 9 boundaries.
- B. Hot Mix Asphalt Pavement for use other than traveled way, wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 40°F or higher and the area to be paved is not frozen.
- C. Hot Mix Asphalt Pavement to be placed as traveled way, wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined as above is 50°F or higher.
- D. Hot bituminous mixtures used for curb, driveways, sidewalks, islands or other incidentals are not subject to season limitations, except that weather conditions shall be satisfactory for proper handling and finishing of the mixture. Unless otherwise specified, bituminous plant mix shall not be placed on a wet surface or a frozen surface. The air temperature shall be 40°F or higher.
- E. When it is in the public interest for service to traffic, the Engineer may authorize construction of Hot Mix Asphalt Pavements at lower atmospheric temperatures than those specified or extend the dates of the paving season.
- F. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F (10 deg C) and rising and will not drop below 50 deg F (10 deg C) within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The materials and their use shall conform to the requirements of Section 401 – Hot Mix Asphalt Pavement of the MDOT Standard Specifications.

2.2 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

- B. Sand: AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: AASHTO M 324, Type IV, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction[, repeating proof-rolling in direction perpendicular to first direction].
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompress existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

- A. The construction requirements shall be as specified in Section 401 – Hot Mix Asphalt Pavement of the MDOT Standard Specifications.

3.6 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - 1. Asphalt Mix: Same as pavement surface-course mix.

- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.7 INSTALLATION TOLERANCES

- A. Per MDOT Standard Specifications.

3.8 FIELD QUALITY CONTROL

- A. General: Comply with requirements of the MDOT Standard Specifications.
- B. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform tests and inspections.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of (cores) taken from the in-place, compacted pavement indicating the percentage of theoretical maximum density (TMD), based on laboratory specimens of the mix combined in the proportions of the job mix formula.
 - 1. Asphalt Pavement Density: Submit laboratory test reports at frequencies not less than one of the following:
 - a. Every 150 Mg placed.
 - b. Each day's placement.
 - c. Each course, each day's placement.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.9 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 32 14 00

UNIT PAVING

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 the following:
 - 1. Concrete pavers set in aggregate setting beds.
 - 2. Edge restraints.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavation and compacted subgrade.
- C. References:
 - 1. ASTM- American Society for Testing & Materials.
 - 2. MDOT - State of Maine Department of Transportation - Standard Specifications for Highways and Bridges, latest edition.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pavers.
 - 2. Edge restraints.
- B. Samples: For the following:
 - 1. Each type of unit paver indicated.
 - 2. Exposed edge restraints involving color selection.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers 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.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.6 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 CONCRETE PAVERS

- A. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936 and resistant to freezing and thawing when tested according to ASTM C 67, made from normal-weight aggregates.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Antara as Distributed by Genest Concrete Products.
 - b. Approved substitute.
 - 2. Thickness: 2-3/8 inches (60 mm).
 - 3. Color: As indicated on the drawings.

2.2 ACCESSORIES

- A. Plastic Edge Restraints: Triangular PVC extrusions 1-3/4 inches (45 mm) high by 3-1/2 inches (89 mm) wide designed to serve as edge restraints for unit pavers; rigid type for straight edges and flexible type for curved edges, with pipe connectors and 3/8-inch (9.5-mm) diameter by 12-inch- (300-mm-) long steel spikes.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BRICKSTOP Corporation.
 - b. PAVE TECH Inc.; Pave Edge.
 - c. Snap Edge Corporation; Snap Edge.

2.3 AGGREGATE SETTING-BED MATERIALS

- A. Sand for Leveling Course: As indicated on the plans.
- B. Sand for Joints: As indicated on the plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Base Approval: Contractor shall examine the base to determine its adequacy to receive concrete pavers on sand/stone dust setting bed or concrete pavers and bituminous setting bed. The base shall be compacted in three inch lifts at optimum moisture density of at least 95%. Gravel base course shall extend for a distance of at least 6" beyond pavement edge.
- C. Start of work of this Section shall constitute acceptance of paved base.

3.2 PREPARATION

- A. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 - 1. For concrete pavers, a block splitter may be used.
- D. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- E. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.

3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade as required in Division 31 Section "Earth Moving".
- B. Install bituminous pavement base as required in Division 31 Section "Asphalt Paving".
- C. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
- D. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- E. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
 1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
 2. Before ending each day's work, fully compact installed concrete pavers to within 36 inches (900 mm) of the laying face. Cover pavers that have not been compacted, and leveling course on which pavers have not been placed, with nonstaining plastic sheets to protect them from rain.
- F. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- G. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- H. Repeat joint-filling process 30 days later.

3.5 REPAIRING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION

SECTION 32 92 00

TURFS AND GRASSES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS: The general provisions of the contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.
- 1.2 RELATED WORK SPECIFIED ELSEWHERE:
- A. Earth Moving: Section 31
 - B. Planting: Section 32
- 1.3 DESCRIPTION OF WORK: Work specified in this section shall consist of furnishing all labor, materials and equipment to perform topsoiling and lawn installation in conformity with the contract drawings and as specified herein. This work includes but is not limited to the following:
- A. Providing all topsoil required for the work of this section.
 - B. Stripping and screening for the work of this section.
 - C. Providing additional new topsoil from off-site sources as required to complete work for this section.
 - D. Providing all soil amendments, fertilizers, erosion controls and mulches as required for work in this section.
 - E. Scarification of subsoil in preparation for loaming.
 - F. Spreading and fine grading topsoil for all lawn areas.
 - G. Seeding and sodding required for work in this section.
 - H. Maintenance and guarantee.
- 1.4 QUALITY ASSURANCE: Subcontract the topsoiling and lawn installation to a single firm experienced in this work.
- A. All seed and soil amendments shall comply with all Federal, State and local laws and regulations requiring inspection for plant disease and insect control.
 - B. Each variety of seed shall have a percentage of germination of not less than 80 and a percentage of purity of not less than 85, and shall have not more than one percent of weed content.
 - C. All seed shall be from the same or previous year's crop unless recent tests by an approved testing agency demonstrate that older seed meets the above requirements.
- 1.5 SUBMITTALS:

- A. Materials list: Submit a complete list of all materials proposed for use in this work, demonstrating complete conformance with the requirements specified.
 - 1. Submit seed vendor's certified statement for each grass mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed.
 - 2. For off site topsoil submit topsoil analysis done by a plant and soil testing agency such as the Maine Soil Testing and Analytical Lab (207) 581-2934 for review by the Owner's Representative. State recommended quantities of amendments necessary to produce satisfactory topsoil as stated in the specifications herein
 - 3. Submit product information with mix ratios and amounts for hydromulching to be used during hydroseeding for Owner's Representative's approval.
 - 4. Submit fertilizer, herbicide and fungicide products for application as required for Owner's Representative's approval.

1.6 PRODUCT HANDLING:

- A. Delivery and Storage:
 - 1. Prior to the installation, cover and store all sod in a cool, dry shaded area.
 - 2. Use all means necessary to protect seed from moisture and other contaminants which may adversely effect proper germination.
 - 3. Use all means necessary to protect fertilizers, amendments and other materials from moisture and other contaminants which may adversely affect their efficacy.

1.7 JOB CONDITIONS: The Contractor must examine the subgrade, verify the elevations, observe the conditions under which work is to be performed and notify the Owner's Representative of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, underground structures or obstructions, notify the Owner's Representative prior to installation for direction. The contractor shall be responsible for correcting such conditions.

PART 2 - PRODUCTS

2.1 TOPSOIL: Topsoil stockpiled from on-site stripping may be utilized if in compliance with the requirements for new topsoil.

A. New Topsoil

1. New Topsoil: Shall be natural, fertile loam typical of cultivated topsoil of the locality, containing not less than 3.5% or more than 8% by weight, of decayed organic matter (humus) as determined by ASTM F-1647.
2. Topsoil shall be taken from a well-drained, arable site, free of subsoil, earth clods, large stones, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter or debris. Topsoil shall have been screened to a maximum stone size of $\frac{3}{4}$ in.
3. Topsoil shall be free of Quack-grass rhizomes, *Agropyron Repens*, and the nut-like tubers of Nutgrass, *Cyperus Esculentus*, and all other primary noxious weeds.
4. Topsoil shall have a pH not less than 6.0 or greater than 6.8.
5. Topsoil shall have a loam texture classification and not be delivered or used while in a frozen or muddy condition.
6. Topsoil shall conform to the following particle size distribution, as determined by pipette method in compliance with ASTM F-1632:

Sand	40-60%
Silt	30-40%
Clay	5-20%

If determined by a soil test the existing topsoil that was stripped does not meet these specifications, the topsoil may be amended to provide an acceptable topsoil for use or replaced by an imported topsoil which conforms to the topsoil specification.

B. Soil Analysis:

1. The Contractor shall submit representative samples of topsoil he intends to bring onto the site to a Soil Plant Testing Laboratory acceptable to the Owner's Representative. The analysis report shall contain the following information: texture class, soil pH, organic matter content, exchangeable Ca, Mg, K, P, lime and fertilizer recommendation. All reports shall be sent to the Owner's Representative for review. The cost for testing and analysis of soils shall be borne by the contractor.
2. Samples of topsoil to be brought to the site must be approved by the Owner's Representative prior to delivery. Deficiencies in the topsoil shall be corrected by the Contractor, as directed by the testing agency report and approved by the Owner's

Representative.

2.2 SOIL AMENDMENTS:

A. Lime

1. Lime shall be an approved agricultural dolomitic limestone containing no less than fifty (50%) percent of total carbonates and twenty five (25%) percent total magnesium with a neutralizing value of at least one hundred (100%) percent.
2. The material shall be ground to such a fineness that forty (40%) percent will pass through a Number 100 U.S. Standard Sieve, and ninety eight (98%) percent will pass through a Number 20 U.S. Standard Sieve.
3. The lime shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.
4. Any lime which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

B. Fertilizer:

1. Fertilizer: Fertilizer with a nutrient analysis as recommended by the soil analysis and approved by the Owner's Representative.

C. Organic Amendments: If organic matter is needed to obtain the specified matter content the organic source may be peat or compost material.

1. Peat: Shall be Canadian sphagnum peat having an ash content not exceeding 15% as determined by ASTM D-2974.
2. Compost: Shall be mature, loose and friable, dark brown or black in color and low enough moisture content to handle easily. Odors should be minimal. The compost shall have virtually no human pathogens. It will have few or no weeds, viable seeds, roots or rhizomes. The compost should meet the following requirements

- | | |
|----------------------|-----------------------------------|
| a. pH | 6.1 – 7.8 |
| b. CaCO3 Equivalency | provide information |
| c. Coarseness | 100% passing 3/8 inch sieve |
| d. Nutrients | provide NPK level information |
| e. Soluble Salts | < 2mnho/cm in final topsoil mix |
| f. Moisture | 40-60% |
| g. Foreign Matter | Less than 2% on dry weight basis. |
| h. Organic Matter | 3-6% of final topsoil mix |

- i. Heavy Metals, PCB's & Dioxins Meets DEP limits for lawn compost.

The contractor shall supply the following information to the Owner's Representative for approval prior to purchasing and incorporating compost products.

2.3 WATER: Water for the Contractor's use shall be supplied by the Owner unless otherwise specified. It shall be the Contractor's responsibility to provide all equipment, hoses, etc. for watering throughout the project and left in place until final acceptance of lawn and turf areas by the Owner's Representative.

2.4 GRASS AND SOD: Provide fresh, clean, new crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. Provide seed of the grass species in the proportions specified.

A. Seed

- 1. Lawn Mixture (sunny areas)
 - Creeping Red Fescue (2 varieties min.) 30%
 - Kentucky Blue Grass (2 varieties min.) 60%
 - Perennial Ryegrass (2 varieties) 10%

Apply at the rate recommended by the manufacturer, but not less than (3) three lbs. per 1000 square feet.

B. Hydroseed Mix

- 1. All work shall be carried out by an approved spraying machine specifically used for this work. Amounts of fertilizer and lime used shall reflect recommendations outlined in the Soil Analysis, seed type, variety and seeding rate shall be as listed in the above section. The Contractor shall submit to the Owner's Representative for approval, prior to the start of work, a certified statement as to number of pounds of fertilizer, amounts and types of grass seed, and processed fiber, per one hundred (100) gallons of water

C. Sod Mix

- 1. Kentucky Bluegrass (2 varieties min.)

2.5 MULCH: The contractor shall mulch all seeded areas.

A. Straw Mulch: shall consist of long fibered hay or straw, reasonably free from noxious weeds and other undesirable material. No material shall be used which is too wet, decayed or compacted as to inhibit even uniform spreading.

B. Cellulose Fiber Mulch: shall consist of natural wood, recycled paper or humus cellulose

fiber containing no materials which will inhibit seed germination or plant growth. Sufficient non-toxic water soluble green dye shall be added to provide a definite color contrast to the ground surface to aid in even distribution. Cellulose fiber mulch shall be supplied in moisture resistant sealed bags marked with the manufacturer's name, the air dry weight and composition of the contents.

- C. Hydromulch: Shall be Terra-Sorb GB, or an approved equal. Add Terra-Sorb to the hydroseed tank at the amount of 60 pounds per acre.
- D. Mulch Binder: Mulch binder may be emulsified asphalt of a type acceptable to the Owner's Representative and may be diluted with water to assure even distribution. Other types of approved mulch binders may be used when authorized by the Owner's Representative.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSOIL:

- A. Prior to spreading topsoil, subsoil should be rough graded to correspond with finish grades as indicated on the drawings. Subgrade shall slope to allow for subsurface drainage. Depressions shall be filled, and areas which are highly compacted shall be loosened to a depth which is adequate for the passage of gravitational water through the subsoil.
- B. After acceptance of subsoil grades, loosen and scarify subgrade material two inches to four inches (2"- 4") deep. Remove stones over one and one half (1-1/2") inches, sticks, rubbish, and other deleterious materials which may impede the healthy and vigorous growth of grass. Move no heavy objects or machinery, except as necessary for the spreading of topsoil, over sod and seed beds after preparation of subgrade.
- C. Subsoil which becomes compacted due to excessive construction activity shall be loosened as directed by the Owner's representative at no additional cost to the Owner.
- D. Preparation of Unchanged grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn seeding as follows. Eradicate existing vegetation, till in to a depth of 6" required soil amendments, fill in depressions, remove high areas. Till soil to a homogenous mixture conducive to plant growth.

3.2 SPREADING OF TOPSOIL:

- A. Immediately after approval of subgrade, evenly spread and lightly compact approved topsoil over prepared areas to a minimum depth of six (6) inches unless otherwise specified on the Drawings and to finish grades as indicated on the Drawings. Do not spread topsoil which is in a muddy or frozen condition. Handle no topsoil when in dry or above the plastic limit. The Contractor is responsible for supplying all topsoil needed from off-site sources if on site stockpiles are inadequate.

- B. When possible, spreading of topsoil shall be performed from the center of the lawn area to the perimeter.
- C. Caution should be exercised to minimize or eliminate travel over areas previously covered with topsoil. Topsoil which becomes compacted due to excessive construction activity shall be stripped and re-spread, or loosened as directed by the Owner's Representative at no additional cost to the Owner.

3.3 SEED BED PREPARATION:

- A. Grade all lawn areas to finish grades as indicated on the drawings. When no grades are shown, areas shall have a smooth and continuous grade between existing or fixed controls and elevations shown on plans. Roll, scarify, rake and level as necessary to obtain true even lawn surfaces. All lawn areas shall slope to drain. Finish grades shall be approved by the Owner's Representative prior to commencing any sodding or seeding work.
- B. Provide fertilizer and lime application if recommended by the soil testing lab. Apply with broadcast spreader and incorporate into the top four (4) inches of topsoil.

3.4 SEEDING:

- A. Schedule for Seeding: Sow grass seed between April 1 and June 15, or between August 15 and September 15, except as otherwise approved in writing by the Owner's Representative.
- B. If seeding out of season as described above, the Contractor is still obligated by all conditions and responsibilities described under 3.07 LAWN MAINTENANCE, until final acceptance of all lawn areas.
- C. Before seed is sown, scarify soil and rake until surface is smooth, friable, and of uniformly fine texture. Seed evenly at rates recommended by the supplier and approved by the Owner's Representative, lightly rake and water with fine spray. Method of seeding may be varied at discretion of Contractor. It is his or her responsibility to establish a smooth, uniform turf composed of approved grasses. Do not use wet seed which is moldy or otherwise damaged in transit or storage.
- D. Mulch seeded areas with straw mulch, 1-1/2 to 2 tons per acre. Secure mulch at Contractor's discretion as to method or need. Wood fiber mulch may be substituted at rate of 1,400 pounds per acre.

3.5 FERTILIZING & LIMING:

- A. Apply with broadcast spreader as per soil analysis recommendations.

3.6 LAWN MAINTENANCE:

- A. Maintenance of the grass areas shall begin immediately and continue until acceptance. Maintenance shall generally consist of weeding, mowing, trimming, reseeding or replacement of dead sod, disease and insect pest control, repair of all erosion, and any other procedure consistent with good horticultural practice, necessary to insure normal, vigorous and healthy growth.
- B. Maintenance shall also include filling, regrading, rolling and reseeding as necessary to correct depressions caused by settling, subsidence, or other physical or mechanical damage.
- C. Maintenance shall also include all temporary protection fences, barriers, signs and all other work incidental to proper maintenance.
- D. The Contractor shall be responsible for maintenance to establish a uniform stand of the approved grasses until acceptance. After the grass has started, ALL areas and parts of areas showing poor germination or growth shall be re-seeded, repeatedly, until ALL areas are covered with a satisfactory growth of grass. At the time of the first cutting, mow lawn with sharp mowing units not less than two and one half (2-1/2") inches high. Lawn shall be maintained between two and one half inches to three and one half inches (2-1/2"-3") high. Do not remove more than one third (1/3) of the grass blade. All lawns shall receive a minimum of three mowings before Contractor's request for inspection and acceptance. Additional mowings may be required before acceptance.
- E. The Contractor shall be responsible for supplying and setting up hoses and sprinklers for watering purposes. However, the Owner shall be responsible for watering operations. It shall be the Owner's responsibility to keep newly seeded areas continually moist for three (3) weeks and thereafter approximately one (1) inch per week until acceptance.

3.7 INSPECTION AND ACCEPTANCE:

- A. The Owner's Representative shall inspect the lawns upon written request by the Contractor. The request shall be received at least ten (10) days before the anticipated date of inspection.
- B. Final acceptance will not be granted until ALL seeded and sodded areas are in satisfactory condition. Seeded areas shall have not less than eighty (80) percent coverage of permanent grasses, free from sizable thin or bare spots. Decision of final acceptance shall rest solely with the Owner's Representative.
- C. If the grass is in satisfactory condition, the Contractor's care and maintenance responsibilities will end. If the grass stand is unsatisfactory, the Contractor's maintenance responsibility shall continue, including a normal program of mowing, trimming, reseeding, fertilization and repair until an acceptable stand of grass is achieved.

3.8 CLEAN UP:

- A. Absolutely no debris, fencing or barricades may be left on the site. Excavated material shall be removed as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Owner's Representative, at no cost to the Owner.

END OF SECTION

SECTION 32 93 00

PLANTING

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. Planting soils.
3. Tree stabilization.

B. Related Sections:

1. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
2. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Division 32 Section "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 ALLOWANCES

- A. Allowances for plants are specified in Division 01 Section "Allowances."

1.4 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 ball size not less than sizes indicated; 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 sizes indicated.

- 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 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. Finish Grade: Elevation of finished surface of planting soil.
- G. Planting Area: Areas to be planted.
- H. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- I. 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.
- J. 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.
- K. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- L. 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.
- M. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- N. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 SUBMITTALS

- A. 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.
- B. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- C. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- B. 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 (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- C. Plant Material Observation: Owner's Representative 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's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Notify Owner's Representative of sources of planting materials seven days in advance of delivery to site.

1.7 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 conformance 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 fertilizers, lime, and soil amendments with appropriate certificates.
- C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. 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.

- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- G. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 2. Do not remove container-grown stock from containers before time of planting.
 - 3. 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.

1.8 PROJECT 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. 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 and warranty requirements.
- C. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.9 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, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization edgings.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Periods from Date of Acceptance: 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 will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. 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 date of Substantial Completion.
- B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. 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 date of Substantial Completion.

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 Schedule or Plant Legend shown 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 will be rejected.
 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 Owner's Representative, 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 shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each at least one 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 as shown on Drawings.
- E. 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.

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 PLANTING SOILS

- A. Refer to Division 32 Section "Turf and Grasses" for planting soil requirements.

2.4 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Aged spruce and pine bark, consisting of the outer bark of the trees with minimum hardwood bark. Bark shall be thoroughly mixed and aged in stock piles a minimum of 6 months, partially decomposed, dark brown in color, and generally free of chunks of wood thicker than 1/4". Aged mulch containing an excess of fine particles will not be acceptable.

2.5 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:
 - 1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
 - a. Guying: 30 inches long.
 - b. Staking: 96 inches long.

2. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 14 gauge, with rubber hose or Chain Lock brand plastic tree tie or approved equivalent.
3. Wrapping Material: First quality, heavy, waterproof crepe paper manufactured for this purpose; not less than 4" wide. Install only when required as noted on the drawings.

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 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. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling 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 and which is too 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 Owner's Representative and replace with new planting soil.

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. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's Representative's acceptance of layout before excavating or planting. Make minor adjustments as required.
- C. 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.

3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Spread planting soil to the depth specified on the plans, but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Owner's Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. at a 45-degree angle. Excavations with vertical sides are not acceptable. 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.
 - 1. Excavate planting pit as detailed on the drawings.
 - 2. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 3. Maintain supervision of excavations during working hours.
 - 4. Keep excavations covered or otherwise when unattended by Installer's personnel
- B. Subsoil and topsoil removed from excavations may be used as planting soil, if it is determined to have properties conducive to plant health..
- C. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Before 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. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare [**1 inch (25 mm)**] above adjacent finish grades.

1. 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.
 2. 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.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. 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.

3.7 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas as indicated on the plans.

3.8 EDGING INSTALLATION

- A. Shovel-Cut Edging: Separate mulched areas from turf areas and pavement with a 45-degree, 4- to 6-inch- (100- to 150-mm-) deep, shovel-cut edge

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. Spray or treat as required to keep trees and shrubs free of insects and disease.
- 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 as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents only as necessary and in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.11 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. 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.
- C. After installation and before Substantial Completion nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.12 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 33 05 14

MANHOLES

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 storm drainage structures outside the building, with the following components:
 - 1. Manholes.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 - 2. Division 31 Section "Dewatering" for dewatering of excavations.

1.3 SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. Manholes: Include plans, elevations, sections, details, and frames and covers.
- B. Field quality-control test reports.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Handle manholes according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Diameter: 48 inches minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber. Approved lubricant shall be applied over the inside tongue and over the rubber gasket immediately prior to setting one section on top of another if "O"-Ring joints are used.
7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection. Install in accordance with the manufacturer's requirements.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. [Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. [Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to exterior surfaces.
12. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-(102-mm-) minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using the word or "SEWER" as required.
 - a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.
 - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.2 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60), deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.3 MORTAR

- A. The cement shall be Type II. The mix shall be one (1) part cement to three (3) parts clean, well graded, hard, durable sand. Hydrated lime may be added to the mixture in an amount not to exceed 15% by weight of the cement. The amount of water shall be only the amount necessary to make a workable mix.

2.4 BRICK

- A. Brick for manholes shall meet the latest AASHTO Specification Designation M-91.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Bases shall be placed on a 6" layer of compacted stone bedding.
- C. Install precast concrete manhole sections according to ASTM C 891.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements, unless otherwise indicated.
 1. Set frame on mortared brick courses true to grade and concentric with the opening. All voids beneath the bottom flange and in the brick courses shall be completely filled to make a watertight fit. A ring of mortar at least 1 inch thick shall be placed around the outside of the bottom flange, extending to the edge of the manhole all around its circumference. The bricks and mortar shall not extend beyond the top of precast concrete cone section.

3.3 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.4 ALTERING EXISTING MANHOLES

- A. When altering existing manholes, the structure shall be dismantled sufficiently to allow reconstruction in accordance with the applicable requirements as shown on the Drawings for complete manholes. Each altered manhole shall be cleaned of all accumulated silt, debris or foreign matter prior to final acceptance of work.

3.5 CLOSING ABANDONED SANITARY MANHOLES

- A. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
 - 1. Remove manhole and close open ends of remaining piping.
 - 2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- B. Backfill to grade according to Division 2 Section "Earthwork."

3.6 FIELD QUALITY CONTROL

- A. Leakage tests shall be made and observed by the Owner's Representative on each sanitary manhole. The test shall be an exfiltration test or air vacuum test made as described below, as selected by the Owner's Representative.
- B. Exfiltration Test: After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non- shrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.
 - 1. Test Procedure: The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily watertight. If the test as described above is unsatisfactory as determined by the Owner's Representative or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24 hour period. If the test fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Owner's Representative to bring the leakage within the allowable rate of 1 gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by the Owner's Representative. The manhole shall then be retested and, if satisfactory,

- all interior joints and those exterior joints within 6 feet of the surface shall be filled and pointed.
2. Backfilling: The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at his own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Owner's Representative that the water table is below the bottom of the manhole throughout the test.
- C. Infiltration Test: If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by the Owner's Representative, such a test can be used to evaluate the watertightness of the manhole. However, if the Owner's Representative is not satisfied, the Contractor shall lower the water table and carry out the test as described hereinbefore.
- D. Air Vacuum Test:
1. Manholes shall be tested by a vacuum test immediately after assembly of the manhole and connecting pipes and before any backfill is placed around the manholes.
 2. All lift holes shall be plugged with non-shrink grout from both inside and outside the manhole and all pipes entering the manhole shall be plugged and braced.
 3. The test shall be made using an inflatable compression band, vacuum pump and appurtenances specifically designed for vacuum testing manholes. Test procedures shall be in accordance with the equipment manufacturer's recommendations.
 4. After the testing equipment is in place, a vacuum of 10 inches of Hg shall be drawn on the manhole. The manhole will be considered to have passed the test if the vacuum does not drop more than 1 inch of Hg in two minutes, for manholes up to 10' deep, and less than 1 inch drop in three minutes for manholes greater than 10' deep.
 5. If the manhole fails the initial test, the Contractor shall locate the leakage and make proper repairs as directed by the Owner's Representative, and re-test until a satisfactory test result is obtained.
 6. After the manholes have been backfilled and prior to final acceptance of the project, any signs of leaks or weeping visible from the inside of the manhole shall be repaired as directed by the Owner's Representative and the manhole made watertight.

END OF SECTION

SECTION 33 05 15

CATCH BASINS (DRAINAGE RINGS)

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 storm drainage structures outside the building, with the following components:
 - 1. Catch basins.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 - 2. Division 31 Section "Dewatering" for dewatering of excavations.

1.3 SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. Catch Basins: Include plans, elevations, sections, details, and frames, covers, and grates.
- B. Field quality-control test reports.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Handle [catch basins] [catch basins and stormwater inlets] [stormwater inlets] according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 4. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber. Approved lubricant shall be applied over the inside tongue and over the rubber gasket immediately prior to setting one section on top of another if "O"-Ring joints are used.
 5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
 7. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
 8. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section. Install in accordance with the manufacturer's requirements.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter flat grate with small square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
1. Set frame on mortared brick courses true to grade and concentric with the opening. All voids beneath the bottom flange and in the brick courses shall be completely filled to make a watertight fit. A ring of mortar at least 1 inch thick shall be placed around the outside of the bottom flange, extending to the edge of the manhole all around its circumference. The bricks and mortar shall not extend beyond the top of precast concrete cone section.

END OF SECTION

SECTION 33 11 00

PIPING – WATER 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. This Section includes the following:
 - 1. Water-distribution piping and related components outside the building for water service.
 - 2. Water-distribution piping and related components outside the building for fire-service mains.
- B. Related Sections:
 - 1. Division 31 Section “Earth Moving” for excavation and backfilling.
 - 2. Division 31 Section “Rock Removal” for removal of rock.
 - 3. Division 31 Section “Dewatering” for lowering and disposing of ground water during construction.
 - 4. Division 31 Section “Excavation Support and Protection” for shoring, bracing and sheet piling of excavations.
- C. References:
 - 1. ASTM- American Society for Testing & Materials.
 - 2. AWWA – American Water Works Association.
 - 3. ASME – American Society of Mechanical Engineers.
 - 4. MSS – Manufacturer’s Standardization Society
 - 5. UL – Underwriters Laboratories
 - 6. NFPA – National Fire Protection Agency.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. 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.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Owner's Representative or Local Utility no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without written authorization from Owner's Representative or Local Utility.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.
 - 1. Copper, Pressure-Seal Fittings:
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Viega; Plumbing & Heating Systems.
 - b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, Class 52, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated. The pipe to be centrifugally cast, bituminous coated, double cement lined, seal-coated and manufactured in accordance with the latest revision of AWWA C150 and C151. Note that the cement lining called for above shall be twice the thickness specified in the latest ANSI Specification A21.4 and the interior to be asphalt seal-coated twice. The asphalt seal-coat to be such as not to impart taste or odor to the water contained therein.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, Class 52, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. The pipe to be centrifugally cast, bituminous coated, double cement lined, seal-coated and manufactured in accordance with the latest revision of AWWA C150 and C151. Note that the cement lining called for above shall be twice the thickness specified in the latest ANSI Specification A21.4 and the interior to be asphalt seal-coated twice. The asphalt seal-coat to be such as not to impart taste or odor to the water contained therein.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.

- C. Flanges: ASME 16.1, Class 125, cast iron.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. Hays Fluid Controls; a division of ROMAC Industries Inc.
 - e. JCM Industries.
 - f. Smith-Blair, Inc.
 - g. Viking Johnson.
 - 2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.
 - b. Center-Sleeve Material: Manufacturer's standard.
 - c. Gasket Material: Natural or synthetic rubber.
 - d. Pressure Rating as required.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Victaulic Depend-O-Lok.
 2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - a. Standard: AWWA C219.
 - b. Sleeve Material: Manufacturer's standard.
 - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - e. Pressure Rating as required.
 - f. Metal Component Finish: Corrosion-resistant coating or material.
- D. Flexible Couplings: Flexible couplings shall be ductile iron. Couplings shall be FC2W Ultra-Flex as manufactured by Ford Meter Box Co.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Co.; American Flow Control Div.
 - b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - c. NIBCO INC.
2. Nonrising-Stem, Metal-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
 - 1) Standard: AWWA C500.
 - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

- b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
2. Description: Sleeve and valve compatible with drilling machine.
- a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.
- 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 CORPORATION VALVES AND CURB VALVES

- A. Manufacturers:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amcast Industrial Corporation; Lee Brass Co.
 - b. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - c. Mueller Co.; Water Products Div.
- B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
- 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- B. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
 - 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - 4. Install corporation valves into service-saddle assemblies.
 - 5. Install manifold for multiple taps in water main.
 - 6. Install curb valve in water-service piping with head pointing up and with service box.
- C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Install HDPE pipe according to ASTM D 2774 and ASTM F 645.
- E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- G. Comply with NFPA 24 for fire-service-main piping materials and installation.
- H. Bury piping with minimum depth of cover over top at least 66 inches (1676 mm).
- I. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.3 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:

NTS: Omit the following types not used.

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 1. Concrete thrust blocks.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.6 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.7 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.8 CLEANING AND DISINFECTING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 31 00
SANITARY SEWERAGE PIPING

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 gravity-flow, nonpressure sanitary sewerage outside the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For pipe and fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.2 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.3 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. NDS Inc.
 - f. Plastic Oddities, Inc.

2.4 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.

- a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- 2.5 PIPE INSULATION
- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
 2. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
 2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use cast-in-place concrete supports or anchors.
 3. Install piping below frost line, unless noted otherwise.

- D. No pipe installed will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Owner's Representative. The interior of each length of pipe will be swabbed and wiped clean before installing the next length. No length of pipe shall be installed until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be installed uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the drawings.
- E. The pipe shall be bedded in a compact granular or stone pipe bedding placed on a flat trench bottom. The bedding material shall extend for a minimum of 6 inches below the outside of the pipe at invert to halfway up the pipe barrel. The remainder of the sidefills and cover to a minimum of 6 inches over the top of the pipe shall be filled with compacted granular borrow.
- F. The pipe shall be cut as necessary for appurtenances. Sufficient short lengths of pipe shall be furnished so that pipe entering and leaving appurtenances shall not be more than 2 feet in length measured from the inside face of the manhole.
- G. Pipe Cutting: The cutting of the pipe shall be done in accordance with the pipe manufacturer's recommendations. The pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
 - 2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 PIPE INSULATION

- A. Install 2-in. thick x 4-ft. wide insulation between pipe and culvert or over pipe when noted on plans or as directed by the Owner's Representative.
- B. Install over the pipe when there is less than 5 ft. of cover between the top of pipe and original ground grade.
- C. Install 6 in. above the pipe unless otherwise shown on Drawings.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.6 CLOSING ABANDONED SANITARY SEWERAGE PIPING

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Division 2 Section "Earthwork."

3.7 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over nonferrous piping.

3.8 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.

5. [Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig (69 kPa).
 6. [Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

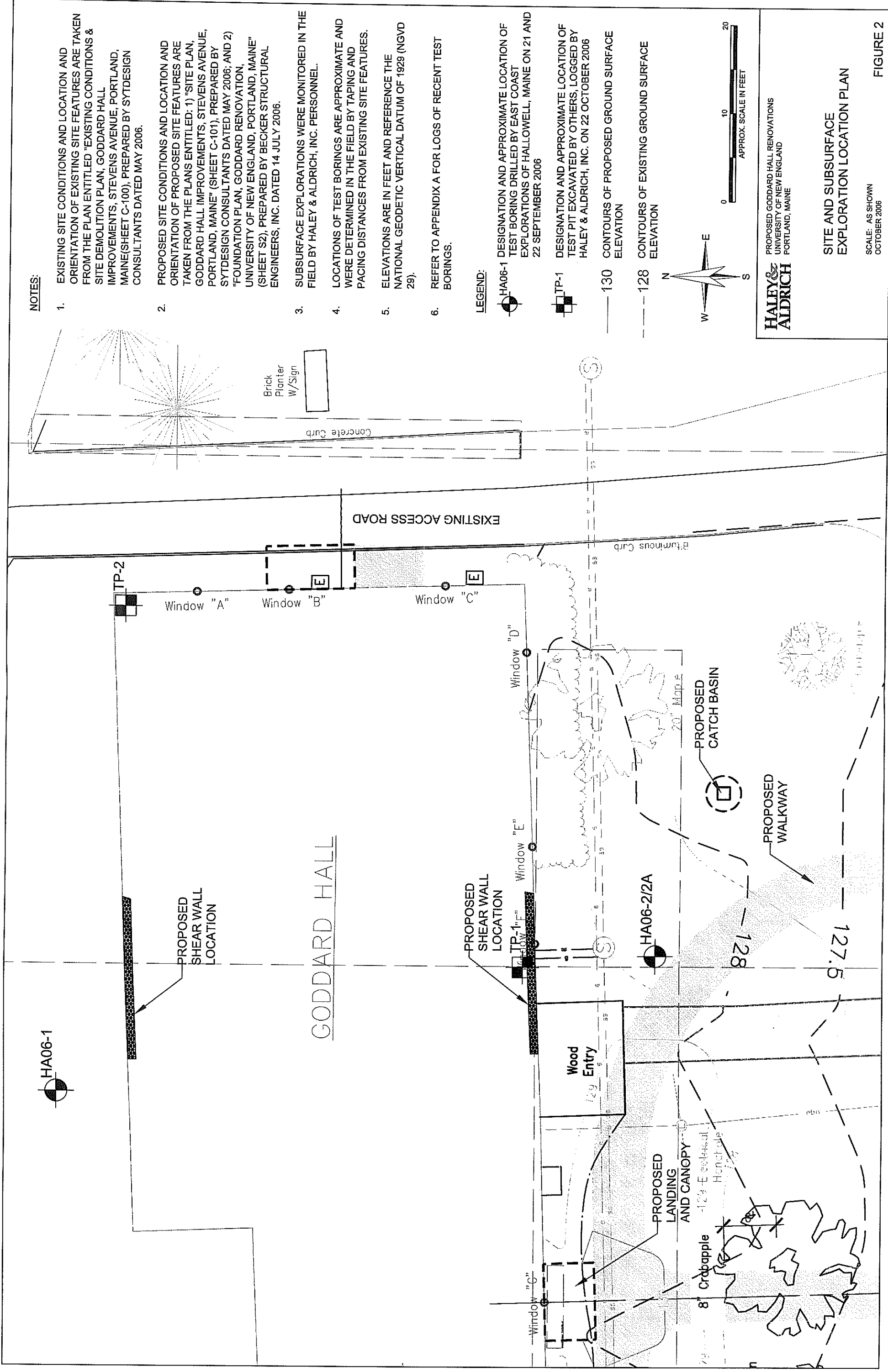
- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

HALEY
ALDRICH

OFFICES



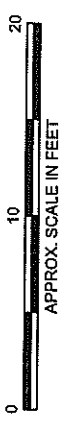
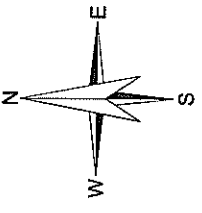


NOTES:

1. EXISTING SITE CONDITIONS AND LOCATION AND ORIENTATION OF EXISTING SITE FEATURES ARE TAKEN FROM THE PLAN ENTITLED "EXISTING CONDITIONS & SITE DEMOLITION PLAN, GODDARD HALL IMPROVEMENTS, STEVENS AVENUE, PORTLAND, MAINE(SHEET C-100), PREPARED BY SYTDESIGN CONSULTANTS DATED MAY 2006.
2. PROPOSED SITE CONDITIONS AND LOCATION AND ORIENTATION OF PROPOSED SITE FEATURES ARE TAKEN FROM THE PLANS ENTITLED: 1) "SITE PLAN, GODDARD HALL IMPROVEMENTS, STEVENS AVENUE, PORTLAND, MAINE" (SHEET C-101), PREPARED BY SYTDESIGN CONSULTANTS DATED MAY 2006; AND 2) "FOUNDATION PLAN, GODDARD RENOVATION, UNIVERSITY OF NEW ENGLAND, PORTLAND, MAINE" (SHEET S2), PREPARED BY BECKER STRUCTURAL ENGINEERS, INC. DATED 14 JULY 2006.
3. SUBSURFACE EXPLORATIONS WERE MONITORED IN THE FIELD BY HALEY & ALDRICH, INC. PERSONNEL.
4. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE DETERMINED IN THE FIELD BY TAPING AND PACING DISTANCES FROM EXISTING SITE FEATURES.
5. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
6. REFER TO APPENDIX A FOR LOGS OF RECENT TEST BORINGS.

LEGEND:

- HA06-1 DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING DRILLED BY EAST COAST EXPLORATIONS OF HALLOWELL, MAINE ON 21 AND 22 SEPTEMBER 2006
- TP-1 DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT EXCAVATED BY OTHERS, LOGGED BY HALEY & ALDRICH, INC. ON 22 OCTOBER 2006
- 130 CONTOURS OF PROPOSED GROUND SURFACE ELEVATION
- 128 CONTOURS OF EXISTING GROUND SURFACE ELEVATION



HALEY & ALDRICH
 PROPOSED GODDARD HALL RENOVATIONS
 UNIVERSITY OF NEW ENGLAND
 PORTLAND, MAINE

**SITE AND SUBSURFACE
 EXPLORATION LOCATION PLAN**

SCALE: AS SHOWN
 OCTOBER 2006

FIGURE 2

1. The first image shows a close-up of a concrete surface with a dark, irregular stain or mark. The stain is located near the top edge of the concrete, and the surrounding area appears to be a light-colored, possibly weathered or aged concrete. The stain has a mottled appearance, with darker and lighter patches, suggesting it might be a liquid spill that has dried or a biological growth.



2. The second image shows a close-up of a concrete surface with a dark, irregular stain or mark. The stain is located near the top edge of the concrete, and the surrounding area appears to be a light-colored, possibly weathered or aged concrete. The stain has a mottled appearance, with darker and lighter patches, suggesting it might be a liquid spill that has dried or a biological growth.







FOR GENERAL INFORMATION ONLY, SEE MASONRY REPOINTING 044640

Date: 12 November 2010

To: Lita Semrau, R.A. & LEED AP
Port City Architecture
65 Newbury Street
Portland, ME 04101

From: Geoffrey E. Melhuish

RE: Goddard Hall, UNE Westbrook Campus Historic Mortar Analysis

Comments:

Ms. Semrau,

Please find enclosed three mortar characterization sheets for mortar samples taken from Goddard Hall (1857) located on the University of New England Westbrook Campus, Portland, Maine. Recommendations for the appropriate mortar mix for rebuilding and repointing the historic building has been provided as well as appropriate cleaning techniques.

METHODOLOGY

Field Investigation

On 4 November 2010, ttl-architects, LLC conducted a site visit at Goddard Hall. The purpose of the visit was to visually inspect the mortar used for the construction of the building and to take samples for laboratory analysis. It appears that approximately 70% of the building has undergone a secondary mortar campaign. While this later campaign is evidenced by slight color and texture variations to the historic mortar, the replacement mortar is a close match to the historic mortar seen mostly along the rear elevation.

Laboratory Analysis

In the laboratory, the mortar sample was analyzed according to procedures developed by the National Park Service for mortar analysis. The laboratory analysis allows for the extraction and characterization of the aggregate. This

allows for the preparation of a mortar that visually matches the original mortar. The data and observations from the analysis were recorded on data sheets and are included, as well as the mix for appropriate repointing mortars. There are several important factors which may affect the condition and performance of mortar which cannot be determined in a laboratory including; the original water content, rate of curing, weather conditions during construction and mixing. The most useful information that can come out of analysis is the identification of the binder to sand ratio, graduation of sand, and color of the fines, which ultimately determine the color of the mortar. It is safe to assume that lime was typically the binder but brick fragments, clay and other products were often used as well.

The samples were ground using a wooden mallet and block so that the sand grains and fines of the mortar mixtures would not be pulverized. The samples were then soaked in a 1:8 solution of Hydrochloric acid and water. The acid dissolves the binder in the mortar enabling the sands and fines to be separated. The samples were dried and the aggregate and fines were weighed and the percentages were calculated.

The samples were sieved in a standard sieve to determine the particle size distribution. Mortar must have a certain percentage of large to small particle sizes in order for optimum performance. Acceptable guidelines on particle size distribution can be found in ASTM C144. In addition a void ratio of the samples were undertaken to determine the space or voids between the individual grains. Typically well-graded sand has a 25-30% void ratio by volume.

SUMMARY OF FINDINGS

Sample 1 - The analysis of the mortar reveals that it is a soft, high sand content lime mortar. The 1857 construction date is consistent with the use of a lime mortar.

Sample 2 - The analysis of the mortar reveals that it is a soft, high sand content lime mortar. The 1857 construction date is consistent with the use of a lime mortar.

Sample 3 - The analysis of the mortar sample reveals that Portland cement was used for a secondary or later pointing campaign at Goddard Hall. Visual observation of the sample prior to wet chemical analysis confirmed that the mortars are largely composed of Portland cement. The gray color of the mortar and its resistance to breakage are both consistent with this material. During wet chemical analysis, gray/green fines were visible in the acid bath; the presence of the fines is a strong indication of Portland cement.

Samples 1 & 2 are uniform in hardness with subtle color variations in appearance. The samples have a similar particle distribution, with a predominance of the aggregate falling into the number 30 (.0215) and 60 (.0092) screens. The two samples contained roughly 3-5% fines. Sample 3 is slightly harder than samples 1 & 2.

RECOMMENDATIONS

Materials

Both the primary and secondary mortars of Goddard Hall are composed primarily of moderately soft mortars. The aggregate used in repointing material should match the data sheets submitted from wet chemical analysis. Use of this type of aggregate will result in a repointing mortar that is visually compatible in both color and texture. It is likely that the sand used in construction of Goddard Hall was obtained locally, based on construction practices of the period and on the physical composition of the sand. The architect will have to approve the local sand identified for the repointing mix to ensure that it matches the original sand and complies with ASTM C-144. Cement used in the repair mixes should be Portland cement, ASTM C-150, Type 1. Hydrated high-calcium lime used should be ASTM C-207, Type N. Type S hydrated lime is not an approved substitute.

For repointing a 1: 1: 6 (Type N) mortar mix is recommended. The mix will provide adequate strength and stability, as well as compatibility with the existing mortar still extant in the wall. The original pointing technique used in the construction of the wall should be replicated.

Cleaning

During the field investigations of Goddard Hall, it was noted that several areas of the elevations are covered by a heavy film of biological growth that appears to have been caused by once leaking downspout and splashback along the beltcourse. Cleaning often is recommended as a treatment option to improve the appearance or remove harmful pollutants and growth of bacteria, algae, and lichens on historic stone buildings. Although a variety of cleaning options are available on the market, many of these products are inappropriate for use on historic buildings.

Use of harsh, abrasive methods of cleaning, such as sandblasting, powerful chemical cleaners, and mechanical cleaning, are not recommended since they can result in irreparable damage to the masonry surface. Cleaning of the masonry units should be by the gentlest means possible, that is the removal of dirt and organic matter from the building surface can be achieved by using a biological cleaner and a low-pressure water wash, scrubbing areas of more persistent grime with a natural bristle (never metal) brush. Several precautions should be taken for a recently repointed masonry wall. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure and test panels should be prepared to evaluate the effects of different cleaning methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes is acceptable.



Laboratory Report: Mortar Characterization

Project: UNE Westbrook	Date: 11/9/10
Building: Goddard Hall	Location: Westbrook Campus
Construction Date: 1857	Elevation: South
Sample # 1	

Field Analysis		
Sample Taken By: John Turk	Sample Location: South between 3 rd & 4 th Window	
Masonry Type: Brick	Joint Condition: Good	Joint Width:
Mortar Texture: Even texture. Smooth surface		
In-Situ Description:		
Mortar Hardness: Extremely Soft		
Mortar Color: 10YR 8/1 White		

Laboratory Analysis	
Analysis By: Geoffrey E. Melhuish	Procedure: National Park Service
Weight (Grams)	Weight (Percentage of Whole)
Sample: 9.15g	Aggregate: 75%
Aggregate: 6.87g	Acid Soluble Material: 22%
Acid Soluble Material: 2.05g	Fines: 3%
Fines: .23g	
Void Ratio: 1:3 or 25%	
Aggregate Characteristics: Primarily translucent quartz; light color aggregate with opaque particles; angular to round.	
Fines Color: 2.5 YR 7/2 Gray	
Notes: Strong reaction with acid	

Particle Distribution

Sieve Screen #	Mesh Size (Inches)	Weight (grams)	% Retained
16	.048	.89g	13%
30	.0215	2.88g	41%
60	.0092	2.65g	37%
100	.006	.34g	5%
Pan	Fines	.23g	3%

Mortar Mix Obtained by Analysis: 1:3.3
Recommended Repair Mortar: 1:1:6 (Six parts well graded sand)

Laboratory Report: Mortar Characterization

Project: UNE Westbrook	Date: 11/9/10
Building: Goddard Hall	Location: Westbrook Campus
Construction Date: 1857	Elevation: North
Sample # 2	

Field Analysis

Sample Taken By: John Turk	Sample Location: Front – One-Story
Masonry Type: Brick	Joint Condition: Good
	Joint Width:
Mortar Texture: Even texture. Smooth surface	
In-Situ Description:	
Mortar Hardness: Extremely Soft	
Mortar Color: 10YR 8/1 White	

Laboratory Analysis

Analysis By: Geoffrey E. Melhuish	Procedure: National Park Service
Weight (Grams)	Weight (Percentage of Whole)
Sample: 9.27g	Aggregate: 75%
Aggregate: 6.96g	Acid Soluble Material: 22%
Acid Soluble Material: 2.10g	Fines: 2.2%
Fines: .21g	
Void Ratio: 1:3 or 25%	
Aggregate Characteristics: Primarily translucent quartz; light color aggregate with opaque particles; angular to round.	
Fines Color: 2.5 YR 6/2 Light Brownish Gray	
Notes: Strong reaction with acid	

Particle Distribution

Sieve Screen #	Mesh Size (Inches)	Weight (grams)	% Retained
16	.048	.12g	1.7%
30	.0215	1.87g	26%
60	.0092	4.10g	57%
100	.006	.73g	10%
Pan	Fines	.37g	5.2%

Mortar Mix Obtained by Analysis: 1:3.5
Recommended Repair Mortar: 1:1:6 (Six parts well graded sand)

Laboratory Report: Mortar Characterization

Project: UNE Westbrook	Date: 11/9/10
Building: Goddard Hall	Location: Westbrook Campus
Construction Date: 1857	Elevation: East
Sample # 3	

Field Analysis		
Sample Taken By: John Turk	Sample Location: East Elevation	
Masonry Type: Brick	Joint Condition: Good	Joint Width:
Mortar Texture: Even texture. Smooth surface		
In-Situ Description: Later mortar		
Mortar Hardness: Moderately soft		
Mortar Color: 2.5YR 7/1 Light Gray		

Laboratory Analysis	
Analysis By: Geoffrey E. Melhuish	Procedure: National Park Service
Weight (Grams)	Weight (Percentage of Whole)
Sample: 2.46g	Aggregate: 56%
Aggregate: 1.33g	Acid Soluble Material: 37%
Acid Soluble Material: .89g	Fines: 5.9%
Fines: .14g	
Void Ratio: 1:3 or 25%	
Aggregate Characteristics: Primarily translucent quartz; opaque particles; mostly angular.	
Fines Color: 2.5YR 8/1 White	
Notes: Grayish/Green fines. Slight odor of Portland cement.	

Particle Distribution

Sieve Screen #	Mesh Size (Inches)	Weight (grams)	% Retained
16	.048	.06g	4.1%
30	.0215	.22g	15%
60	.0092	.83g	56%
100	.006	.24g	16.3%
Pan	Fines	.11g	7.5%

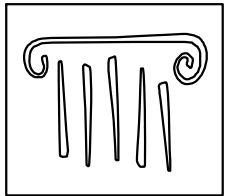
Mortar Mix Obtained by Analysis: 1:2
Recommended Repair Mortar: 1:1:6 (Six parts well graded sand)

MASONRY RESTORATION KEY NOTES

- (A) PROTECT MASONRY AND OTHER SURROUNDING ARCHITECTURE AND LANDSCAPE FEATURES TO REMAIN.
- (B) MASONRY BIOCIDE CLEANER APPLICATION (**BASE BID**). ASSUME MINIMUM OF TWO APPLICATIONS. SEE SPECIFICATION REQUIREMENTS.
- (C) MASONRY RUST REMOVAL APPLICATION (**ADD ALTERNATE #1**). ASSUME MINIMUM OF TWO APPLICATIONS. SEE SPECIFICATION REQUIREMENTS.
- (D) HAND RAKE EXISTING MORTAR WASH AT CORBELLED ARCH ABOVE WINDOW. ASSUME 30% REMOVAL AT EACH ARCH AT A DEPTH OF 1-1/2". RECREATE WASH WITH POINTING MORTAR AS SPECIFIED.
- (E) HAND RAKE EXISTING MORTAR WASH AT CORBELLED BELT COURSE. ASSUME 100% REMOVAL FOR ENTIRE LENGTH OF CORBEL. RECREATE WASH WITH POINTING MORTAR AS SPECIFIED.
- (F) HAND RAKE EXISTING MORTAR JOINT AT DEFINED CRACK. ASSUME DEPTH OF REMOVAL TO BE 2-1/2". REPOINT AS SPECIFIED.
- (G) 100% HAND RAKE EXISTING MORTAR JOINTS WITHIN DEFINED AREA. ASSUME DEPTH OF REMOVAL TO BE 2-1/2". REPOINT AS SPECIFIED.
- (H) REMOVE EXTERIOR WYTHE OF BRICK AT DEFINED AREA. PROVIDE TEMPORARY SHORING AS NEEDED TO PREVENT SELLING OF EXISTING MASONRY TO REMAIN. INSTALL MATCHING RESTARATION BRICK AS SPECIFIED.
- (J) REMOVE EXISTING SEALANT AND ANY REMAINING, UNSOUND MORTAR AT GRANITE - BRICK JOINT. ASSUME HAND RAKE REMOVAL OF 2-1/2". REPOINT AS SPECIFIED.
- (K) FILL EXISTING VOID AT CHIMNEY BASE WITH RESTORATION BRICK AS SPECIFIED. ASSUME REBUILD OF TWO WYTHES THICK. TOOTH BOTH WYTHES INTO EXISTING BOND PATTERN.
- (L) REMOVE EXISTING METAL FLASHING AND JOINT SEALANT. HAND RAKE ANY REMAINING UNSOUND MORTAR TO 2-1/2" DEPTH. REPOINT AS SPECIFIED.
- (M) EXISTING STEEL FIRE ESCAPE TO BE REMOVED BY OTHERS. ASSUME 100% HAND RAKE AND REPOINT IMMEDIATELY BEHIND FIRE ESCAPE COMPONENTS THAT ABUTT MASONRY. SEE SPECIFICATION REQUIREMENTS.
- (N) REMOVE ANY REMAINING STEEL AT OLD FIRE ESCAPE ATTACHMENT POINTS. GRIND AS NECESSARY AT MINIMUM. DIAMETER TO PERFORM REMOVAL. PATCH BRICK WITH POINTING MORTAR THAT HAS BEEN TINTED TO MATCH BRICK COLOR. OBTAIN ARCHITECT APPROVAL FOR COLOR MATCH. MORTAR JOINTS SHALL BE POINTED WITH NON-TINTED MORTAR.
- (O) EXISTING METAL DOWNSPOUT TO BE REMOVED BY OTHERS. MASON TO REMOVE DOWNSPOUT HANGER ATTACHMENTS AND PATCH BRICK WITH TINTED MORTAR. ASSUME 100% HAND RAKE AND REPOINT IMMEDIATELY BEHIND DOWNSPOUT COMPONENTS. SEE SPECIFICATION REQUIREMENTS.

MASONRY RESTORATION GENERAL NOTES

1. SEE ATTACHED MASONRY SPECIFICATION SECTION 042030 SELECT MASONRY CLEANING FOR BIOCIDE CLEANING PROCEDURE AND RUST REMOVAL CLEANING PROCEDURE. NOTE THAT RUST REMOVAL IS TO BE PRICED AS ADD ALTERNATE #1.
2. BIOCIDE CLEANING PROCEDURE AND RUST REMOVAL CLEANING PROCEDURE SHALL BE UNDERTAKEN PRIOR TO ANY OTHER MASONRY RESTORATION WORK.
3. SEE ATTACHED MASONRY SPECIFICATION SECTION 042110 FOR SELECT MASONRY REMOVAL AND REPLACEMENT PROCEDURE.
4. SEE ATTACHED MASONRY SPECIFICATION SECTION 044640 FOR SELECT MASONRY REPOINTING PROCEDURE.
5. SEE ATTACHED HISTORIC MORTAR ANALYSIS LAB RESULTS FOR INFORMATION PURPOSES ONLY. FOLLOW PROCEDURE OUTLINED IN SPEC SECTION 044640 FOR REPOINTING REQUIREMENTS.
6. MASON SHALL PERFORM A VISUAL INSPECTION OF EXISTING CONDITIONS PRIOR TO PRICING WORK. NOTIFY ARCHITECT OF ANY DISCREPENCIES PRESCRIBED BY THE CONTRACT DOCUMENTS WITH EXISTING CONDITIONS AT TIME OF PRE-BID INSPECTION.
7. MASON SHALL NOTIFY ARCHITECT IMMEDIATELY UPON DISCOVERY OF HIDDEN CONDITIONS NOT REASONABLY ANTICIPATED OR PRESCRIBED BY CONTRACT DOCUMENTS.
8. MASON SHALL BE RESPONSIBLE FOR INSTALLATION OF ANY TEMPORARY SHORING NEEDED TO PREVENT SETTLING OF EXISTING MASONRY SCHEDULED TO REMAIN IN PLACE.
9. MASON SHALL MAKE EVERY EFFORT POSSIBLE TO PROTECT EXISTING OR RESTORED MASONRY WORK FROM DAMAGE AND SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT OF ANY DAMAGED MASONRY CAUSED BY MASONRY RESTORATION ACTIVITIES. REPAIR OR REPLACEMENT SHALL MATCH CONDITIONS REQUIRED BY CONTRACT DOCUMENTS.
10. MASON SHALL COORDINATE WITH CONTRACTOR ALL MEANS AND METHODS NECESSARY TO PERFORM THE MASONRY RESTORATION WORK. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT IN-KIND OF ANY DAMAGE CAUSED TO SURROUNDING BUILDING OR LANDSCAPE FEATURES.
11. MASON SHALL BE RESPONSIBLE FOR REMOVAL OF MISCELLANEOUS SCREWS, NAILS, HOOKS, LET-INS AND OTHER ABANDONED ATTACHMENT. REMOVE ALL FERROUS MATERIAL AND REPOINT AS SPECIFIED. HOLES IN BRICK LARGER THAN 1/8" RESULTING FROM REMOVAL SHALL BE PATCHED WITH TINTED MORTAR TO MATCH.
12. SEE MASONRY RESTORATION SPECIFICATION SECTIONS FOR REQUIRED MOCK-UPS. MASON AND GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING MOCK-UP LOCATIONS WITH ARCHITECT AND SHALL OBTAIN APPROVAL FROM ARCHITECT PRIOR TO PROCEEDING WITH WORK. PROVIDE ARCHITECT WITH AT LEAST 72 HOUR NOTICE OF INTENT TO BEGIN WORK TO ALLOW TIME TO COORDINATE SITE VISIT.
13. MASON SHALL PERFORM ANY NECESSARY CORING REQUIRED FOR INSTALLATION OF NEW ITEMS TO BE ATTACHED TO RESTORED MASONRY SURFACES. GENERAL CONTRACTOR SHALL COORDINATE ITEMS REQUIRING CORING WITH MASON.
14. NOTE THAT POWER OPERATED ROTARY HAND SAWS AND GRINDERS SHALL BE PROHIBITED. TROW AND HOLDEN PNEUMATIC MASONRY RESTORATION TOOLS MAY BE USED IF APPROVED BY THE ARCHITECT. QUALITY CONTROL PROGRAM SHALL INCLUDE PROVISIONS FOR SUPERVISING PERFORMANCE AND PREVENTING DAMAGE CAUSED BY WORKER FATIGUE. QUALITY CONTROL PROGRAM SHALL ALSO REQUIRE OPERATORS TO DEMONSTRATE ABILITY TO USE RESTORATION TOOLS WITHOUT DAMAGING MASONRY.



PORT CITY
ARCHITECTURE

65 NEWBURY STREET
PORTLAND, ME 04101
207.761.9000
fax: 207.761.2010
info@portcityarch.com

tll- architects

28 Danforth Street, Suite 213
Portland, Maine 04101
ph: 207.761.9662

GODDARD RENOVATION
EXTERIOR SHELL

UNIVERSITY of NEW ENGLAND
Portland, Maine

Date Issued NOVEMBER 17, 2010

Project Number 10538

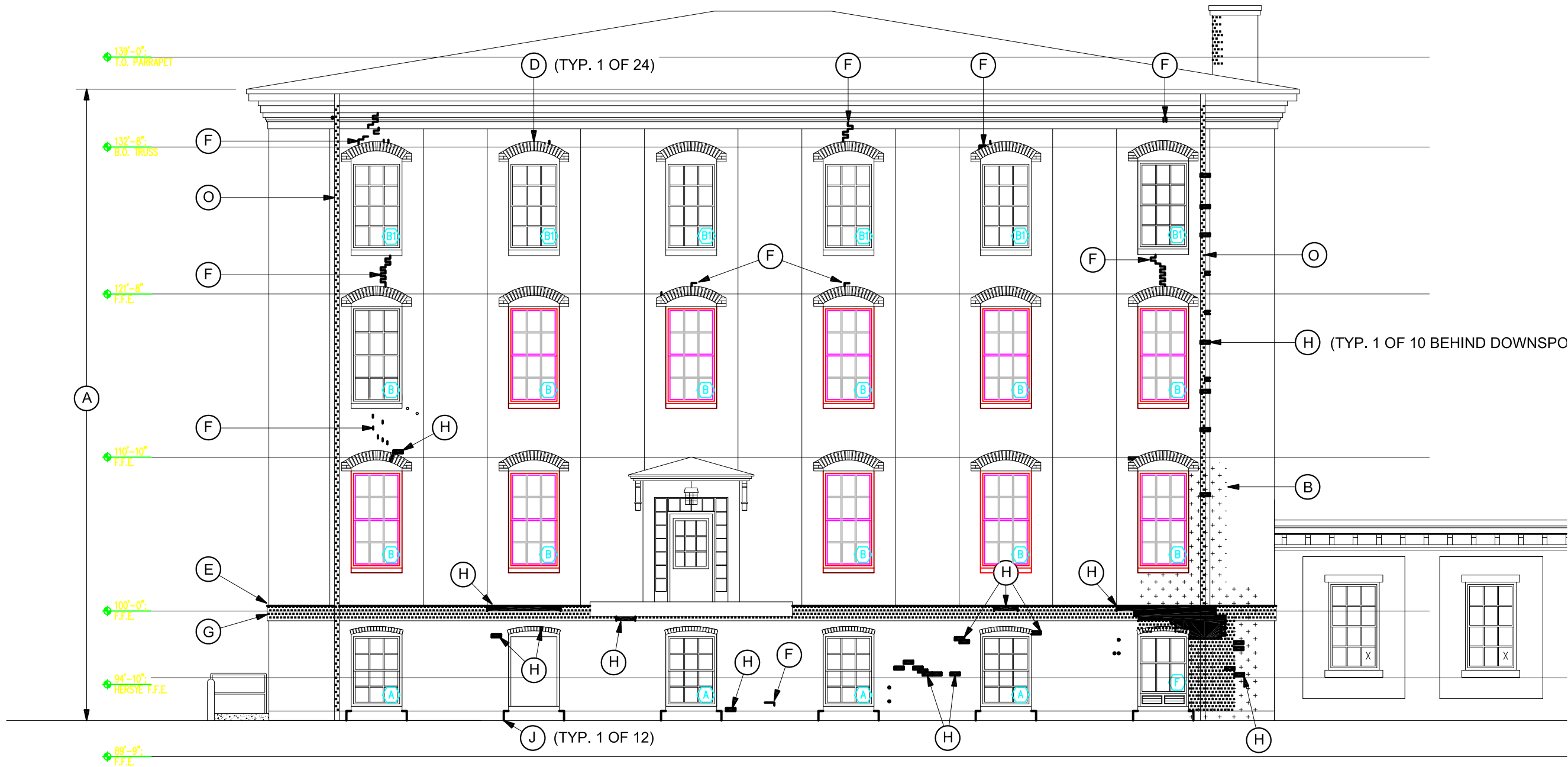
Drawing Scale - 1/8" = 1'-0"

MASONRY RESTORATION
KEY NOTES

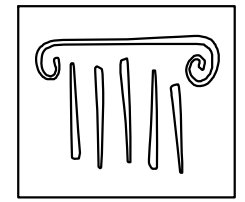
Drawn By
JDT

Checked By
LAS

B1.0



1 MASONRY RESTORATION AT NORTH ELEVATION
 B1.1 1/8" = 1'-0"
 SEE SHEET B1.0 FOR KEY NOTES AND GENERAL NOTES



PORT CITY ARCHITECTURE

65 NEWBURY STREET
 PORTLAND, ME 04101
 207.761.9000
 fax: 207.761.2010
 info@portcityarch.com

tll- architects

28 Danforth Street, Suite 213
 Portland, Maine 04101
 ph: 207.761.9662

GODDARD RENOVATION
 EXTERIOR SHELL

UNIVERSITY of NEW ENGLAND
 Portland, Maine

Date Issued NOVEMBER 17, 2010

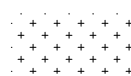
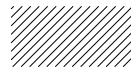
Project Number 10538


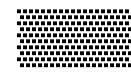
Drawing Scale - 1/8" = 1'-0"

MASONRY RESTORATION
 NORTH ELEVATION

Drawn By JDT	B1.1
Checked By LAS	

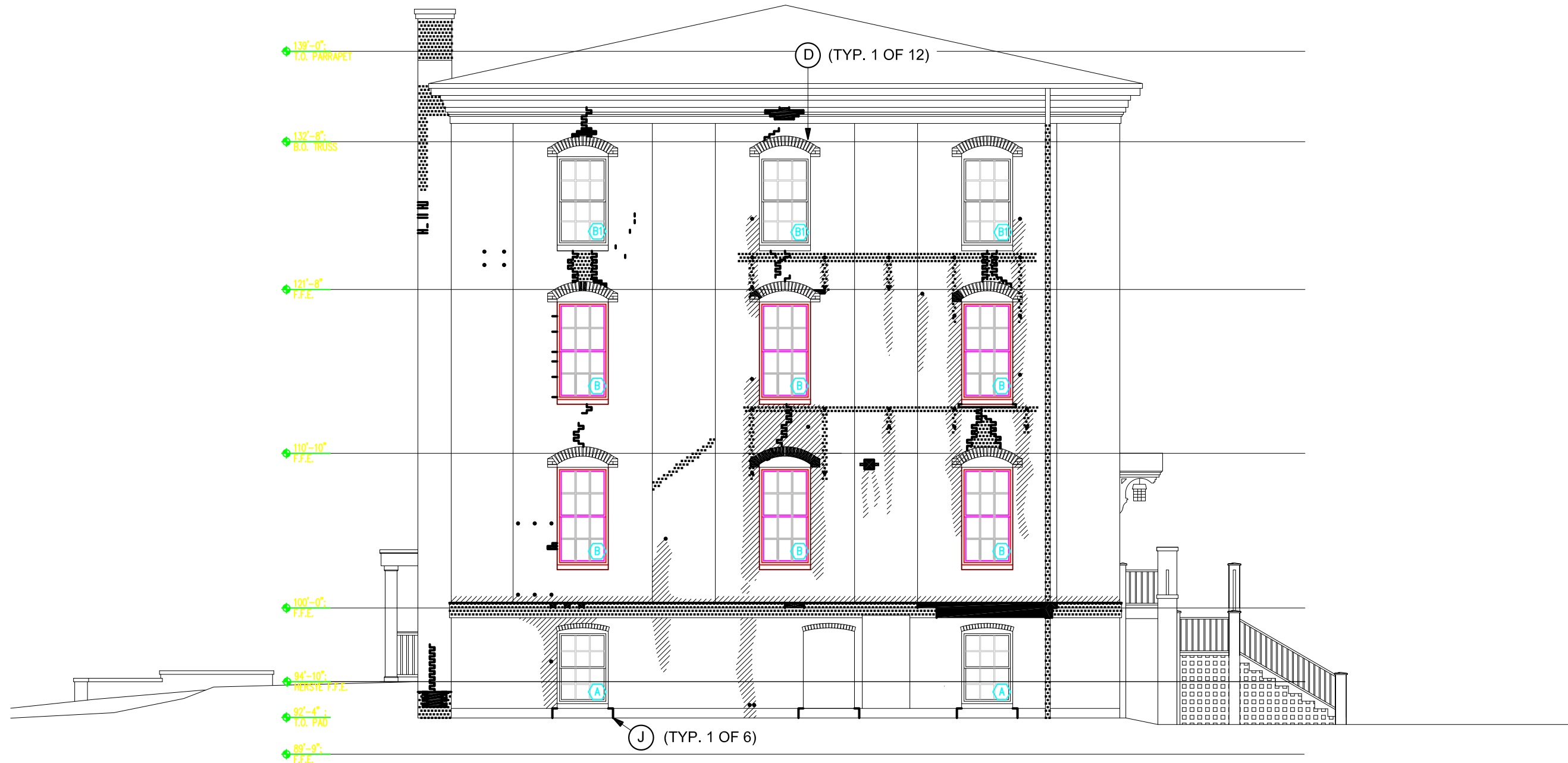
MASONRY RESTORATION KEY

-  BIOCIDE CLEANING APPLICATION (BASE BID)
AS PER SPECIFICATION 042030
-  RUST REMOVAL APPLICATION (ADD ALTERNATE #1)
AS PER SPECIFICATION 042030

-  REPOINT DETERIORATED MORTAR JOINT
AS PER SPECIFICATION SECTION 044640
-  REPOINT MASONRY FIELD AS PER
SPECIFICATION SECTION 044640

-  REMOVE AND REPLACE DAMAGED BRICK
AS PER SPECIFICATION SECTION 044640

BID SET - NOT FOR CONSTRUCTION



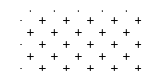
1
B1.2

MASONRY RESTORATION AT EAST ELEVATION

1/8" = 1'-0"

SEE SHEET B1.0 FOR KEY NOTES AND GENERAL NOTES

MASONRY RESTORATION KEY



BIOCIDE CLEANING APPLICATION (BASE BID)
AS PER SPECIFICATION 042030



RUST REMOVAL APPLICATION (ADD ALTERNATE #1)
AS PER SPECIFICATION 042030



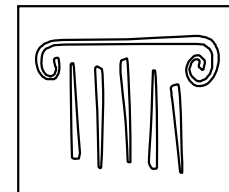
REPOINT DETERIORATED MORTAR JOINT
AS PER SPECIFICATION SECTION 044640



REPOINT MASONRY FIELD AS PER
SPECIFICATION SECTION 044640



REMOVE AND REPLACE DAMAGED BRICK
AS PER SPECIFICATION SECTION 044640



PORT CITY
ARCHITECTURE

65 NEWBURY STREET
PORTLAND, ME 04101
207.761.9000
fax: 207.761.2010
info@portcityarch.com

tll- architects

28 Danforth Street, Suite 213
Portland, Maine 04101
ph: 207.761.9662

GODDARD RENOVATION
EXTERIOR SHELL

UNIVERSITY of NEW ENGLAND
Portland, Maine

Date Issued NOVEMBER 17, 2010

Project Number 10538

Drawing Scale - 1/8" = 1'-0"

MASONRY RESTORATION
EAST ELEVATION

Drawn By
JDT

Checked By
LAS

B1.2

BID SET - NOT FOR CONSTRUCTION



1 MASONRY RESTORATION AT SOUTH ELEVATION
 B1.3 1/8" = 1'-0"
 SEE SHEET B1.0 FOR KEY NOTES AND GENERAL NOTES

MASONRY RESTORATION KEY



BIOCIDE CLEANING APPLICATION (BASE BID)
 AS PER SPECIFICATION 042030



RUST REMOVAL APPLICATION (ADD ALTERNATE #1)
 AS PER SPECIFICATION 042030



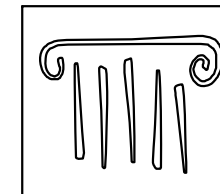
REPOINT DETERIORATED MORTAR JOINT
 AS PER SPECIFICATION SECTION 044640



REPOINT MASONRY FIELD AS PER
 SPECIFICATION SECTION 044640



REMOVE AND REPLACE DAMAGED BRICK
 AS PER SPECIFICATION SECTION 044640



PORT CITY
 ARCHITECTURE

65 NEWBURY STREET
 PORTLAND, ME 04101
 207.761.9000
 fax: 207.761.2010
 info@portcityarch.com

tll- architects

28 Danforth Street, Suite 213
 Portland, Maine 04101
 ph: 207.761.9662

GODDARD RENOVATION
 EXTERIOR SHELL

UNIVERSITY of NEW ENGLAND
 Portland, Maine

Date Issued NOVEMBER 17, 2010

Project Number 10538

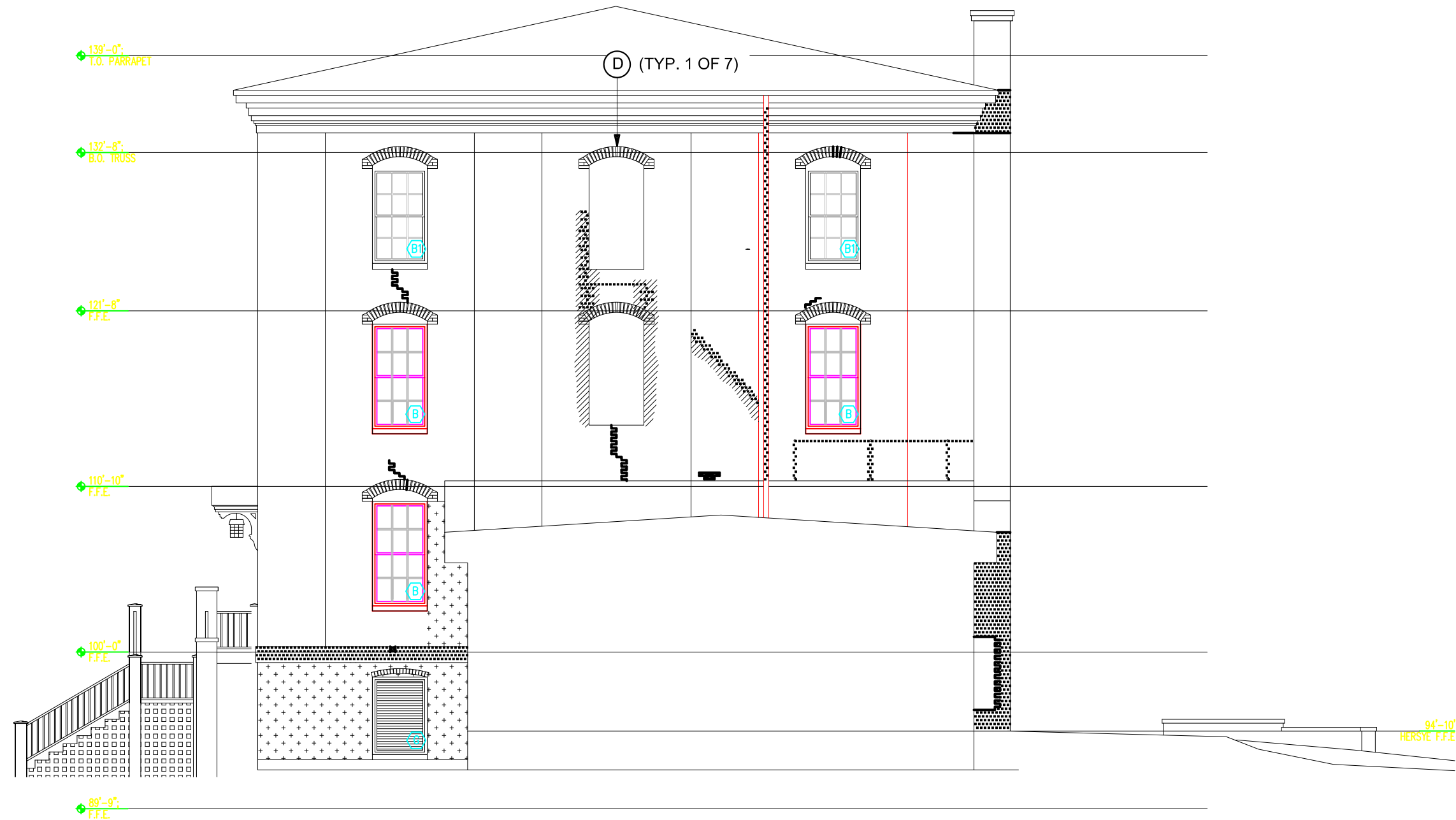
Drawing Scale - 1/8" = 1'-0"

MASONRY RESTORATION
 SOUTH ELEVATION

Drawn By
 JDT
 Checked By
 LAS

B1.3

BID SET - NOT FOR CONSTRUCTION

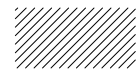


1
B1.4 MASONRY RESTORATION AT WEST ELEVATION
1/8" = 1'-0"
SEE SHEET B1.0 FOR KEY NOTES AND GENERAL NOTES

MASONRY RESTORATION KEY



BIOCIDE CLEANING APPLICATION (**BASE BID**)
AS PER SPECIFICATION 042030



RUST REMOVAL APPLICATION (**ADD ALTERNATE #1**)
AS PER SPECIFICATION 042030



REPOINT DETERIORATED MORTAR JOINT
AS PER SPECIFICATION SECTION 044640

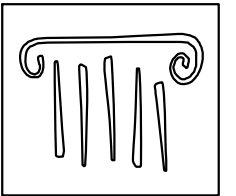


REPOINT MASONRY FIELD AS PER
SPECIFICATION SECTION 044640



REMOVE AND REPLACE DAMAGED BRICK
AS PER SPECIFICATION SECTION 044640

BID SET - NOT FOR CONSTRUCTION



PORT CITY
ARCHITECTURE

65 NEWBURY STREET
PORTLAND, ME 04101
207.761.9000
fax: 207.761.2010
info@portcityarch.com

tll- architects

28 Danforth Street, Suite 213
Portland, Maine 04101
ph: 207.761.9662

GODDARD RENOVATION
EXTERIOR SHELL

UNIVERSITY of NEW ENGLAND
Portland, Maine

Date Issued NOVEMBER 17, 2010

Project Number 10538

Drawing Scale - 1/8" = 1'-0"

MASONRY RESTORATION
WEST ELEVATION

Drawn By
JDT

Checked By
LAS

B1.4